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CIO

THE MAGAZINE FOR INFORMATION EXECUTIVES

MARCH 15, 1999

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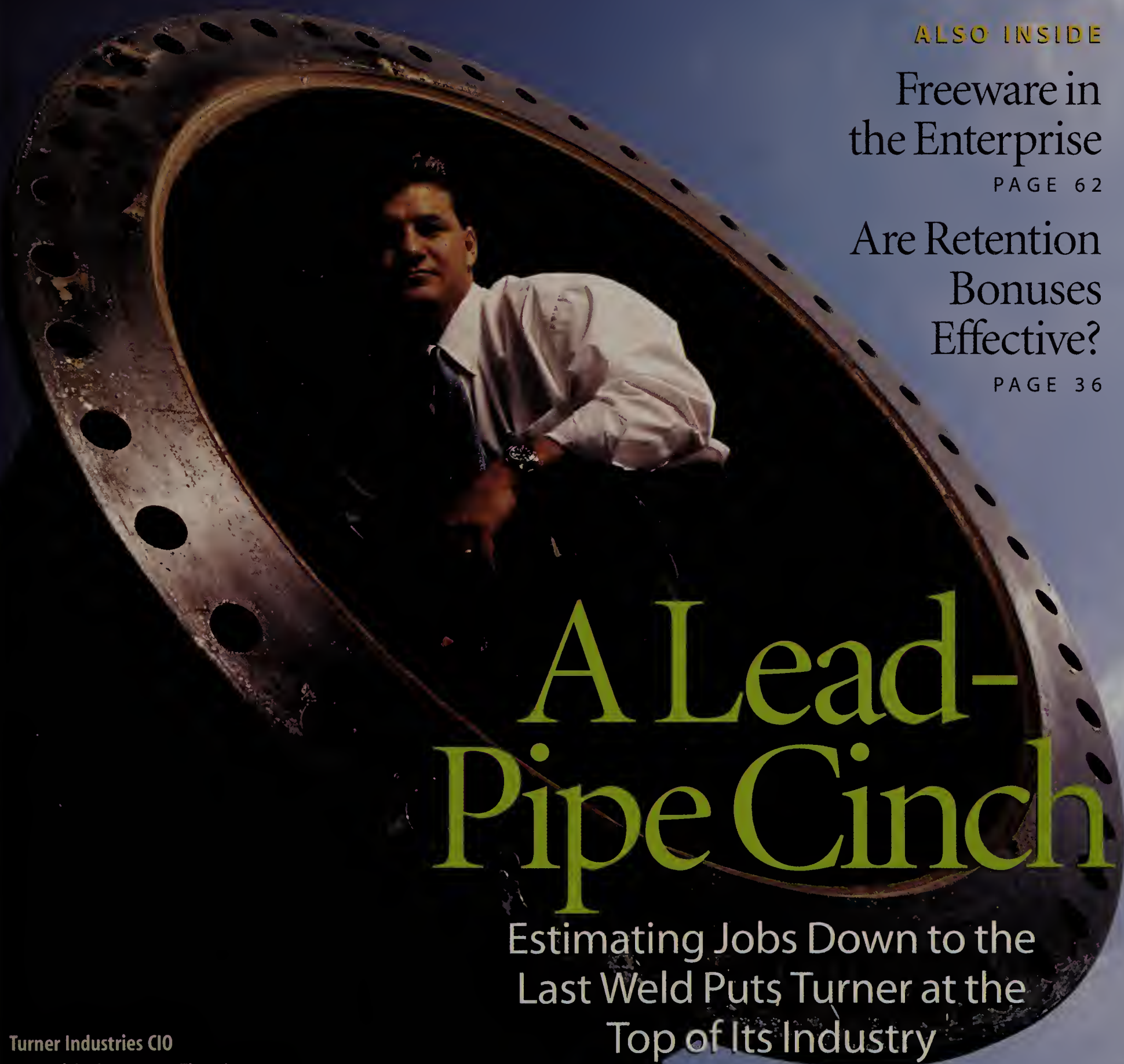

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CIO

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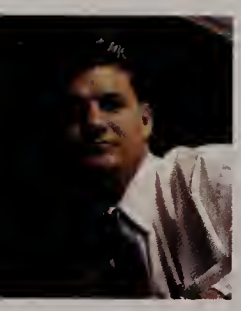

ON THE COVER

G. Patrick Thompson says enhanced IT helped Turner become a leader in its field.

Cover photo by Danny Turner

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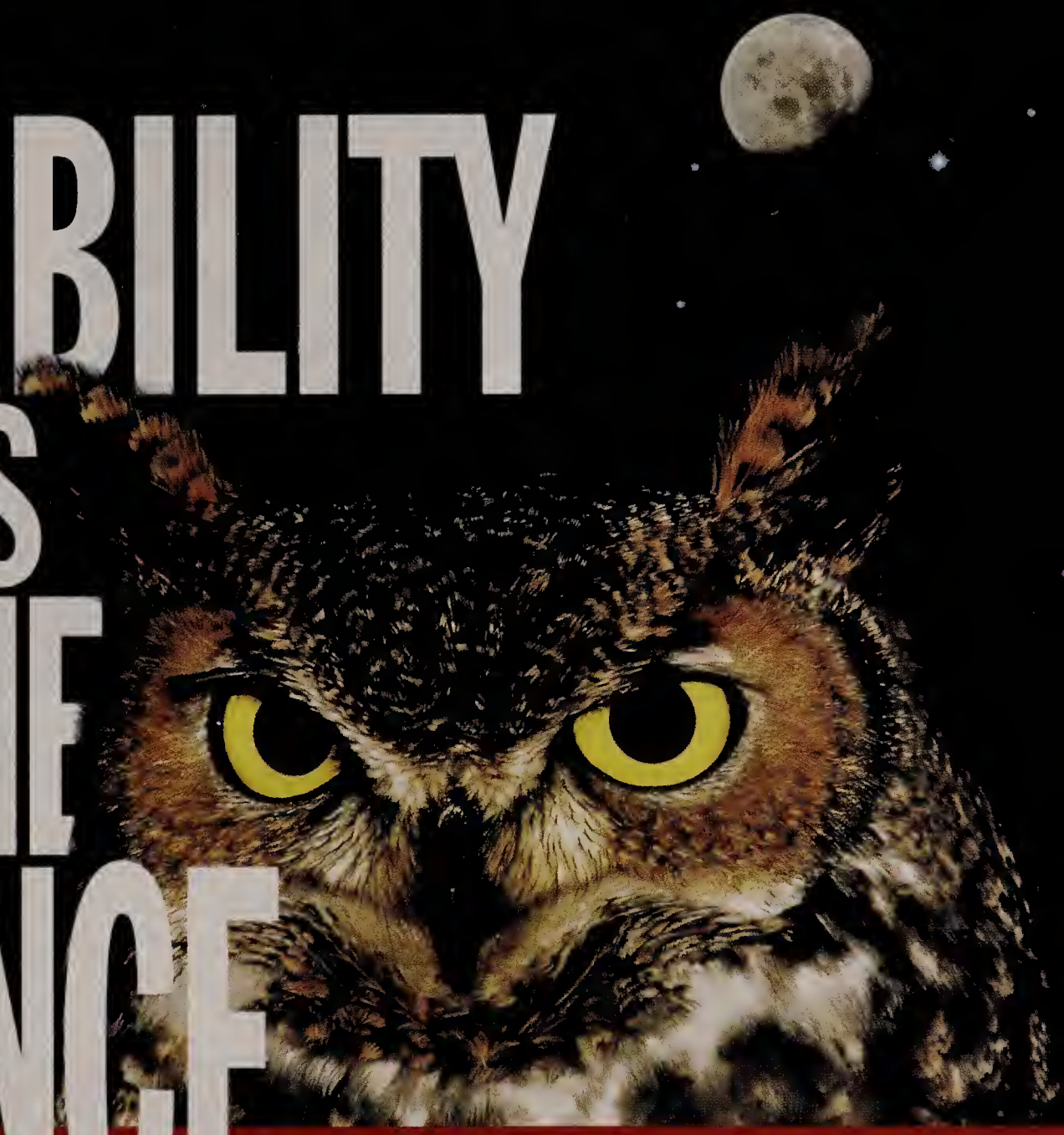

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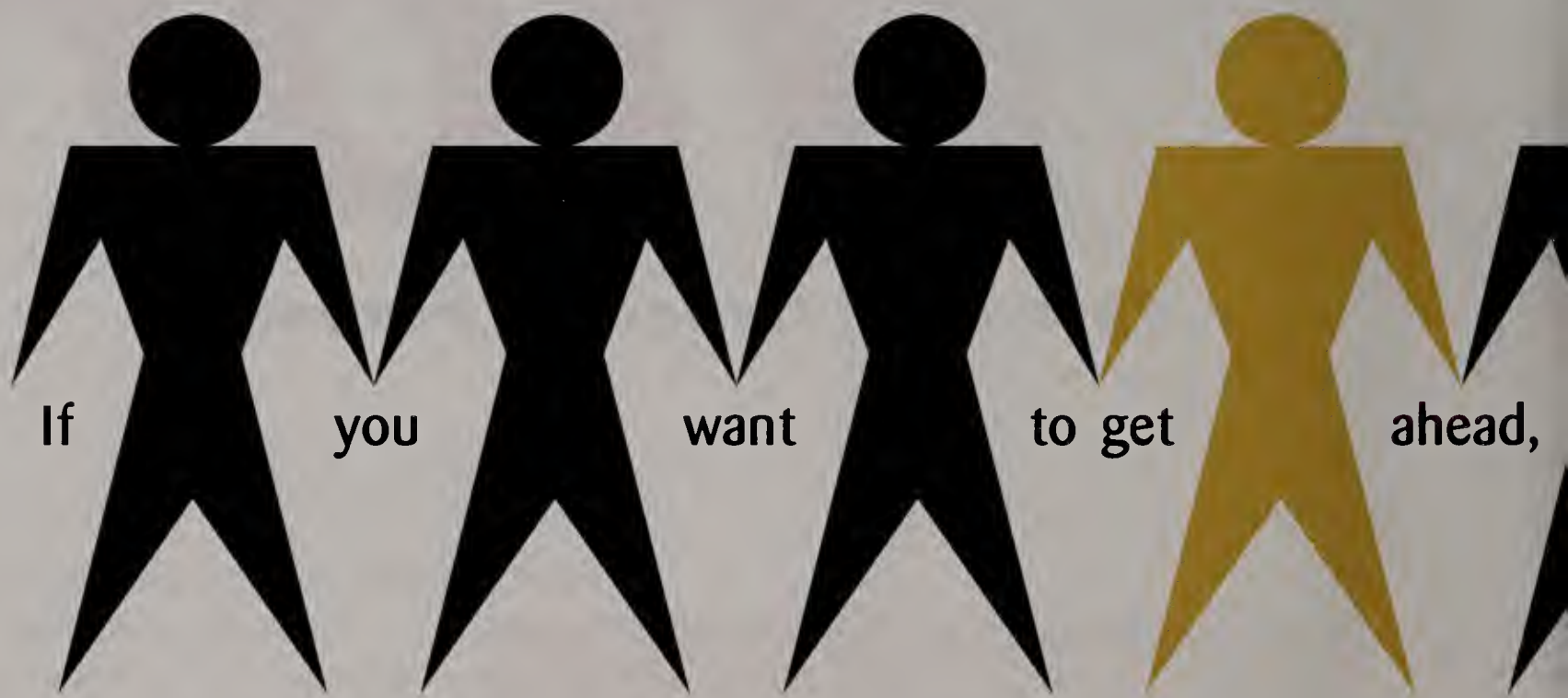

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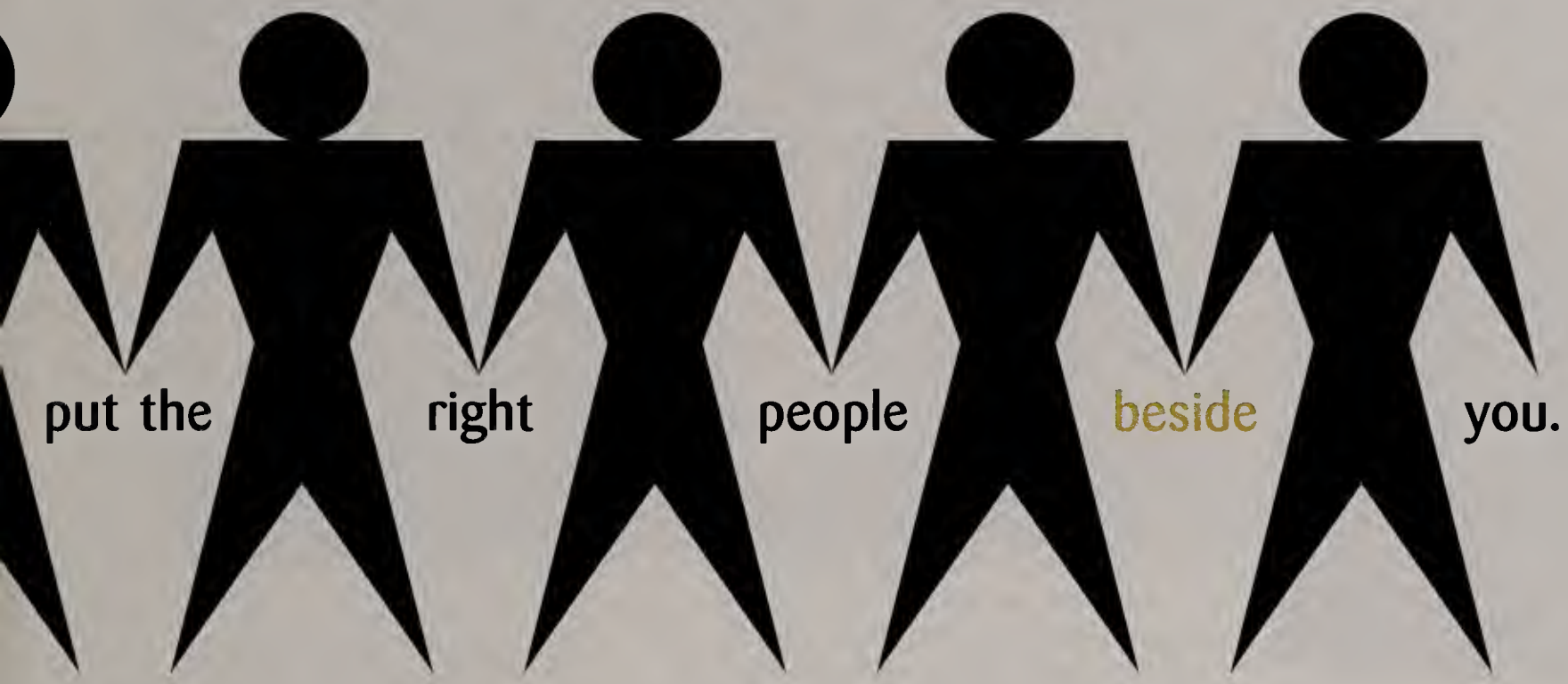

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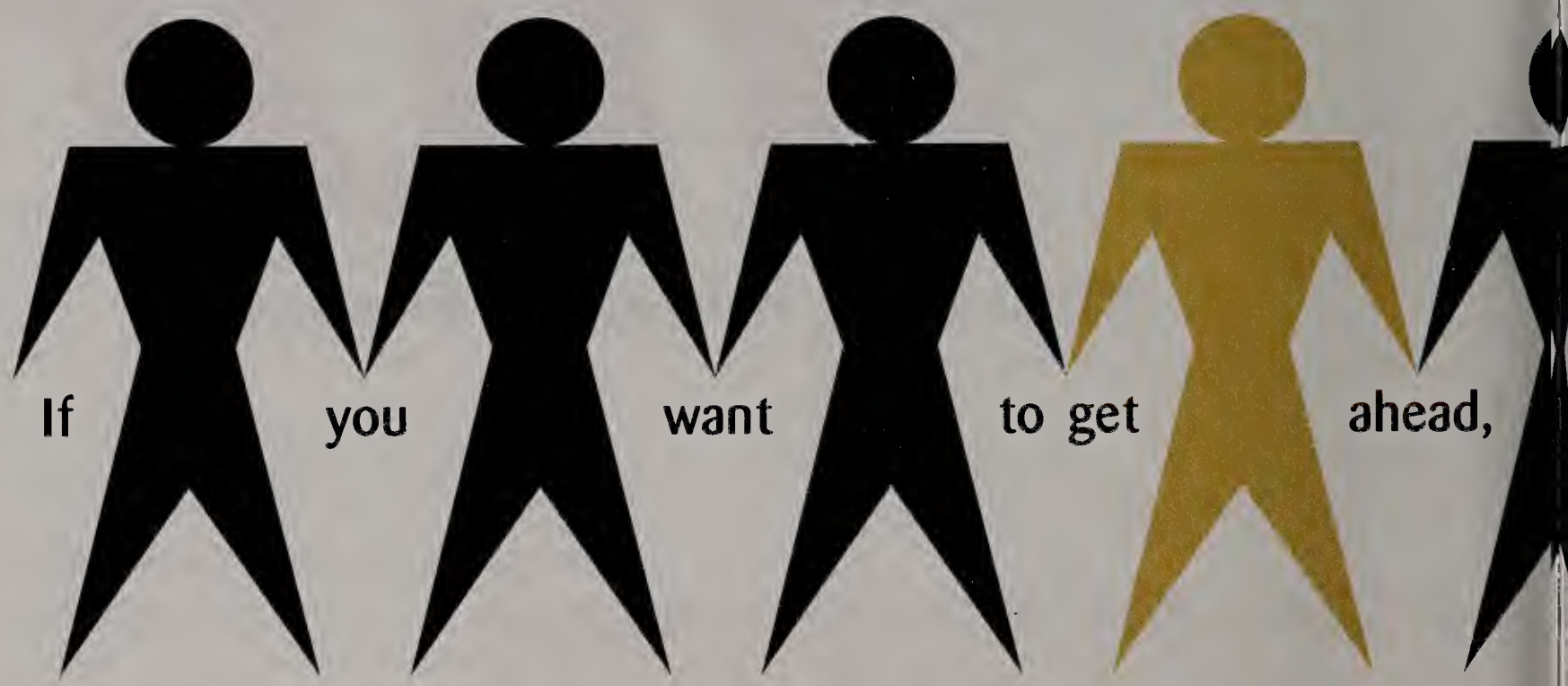

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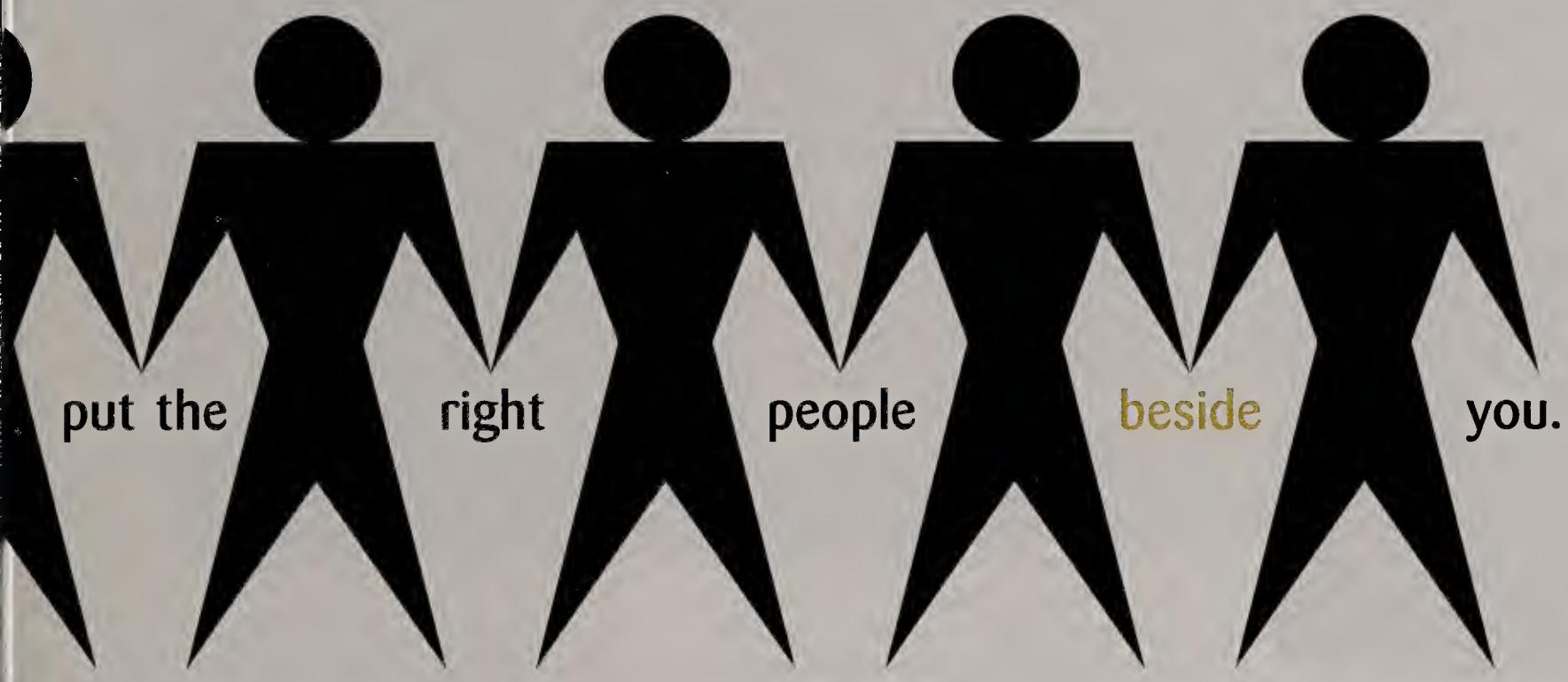

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In Box

LETTER FROM THE EDITOR, READER FEEDBACK AND HOW TO REACH US

The other day, *CIO* Publisher Gary Beach and I were talking about what things are apt to be like next December and January because of the year 2000 computer crisis. We know that the problem is not going to be "fixed" and that there are going to be disruptions and disturbances large and small. We talked about the fact that increasing numbers of businesses and government entities are getting into contingency-planning and crisis-management mode. (Many people are talking about "business resumption," presupposing business interruption.)

Closer to home, Y2K community planning efforts are mushrooming around the country (for more on this, see "Community Ties" on Page 12). Even individuals are talking about how much food and water they plan to have on hand in case of an emergency.

The growing certainty that things will go wrong combined with the almost total uncertainty about what those things will be makes for a highly charged situation. So Gary and I have come to the following conclusion: All businesses should shut down for the week of Jan. 3, 2000. This will achieve three things: It will give the IT and business folks time to fix problems without the pressure of being in full production. It will do an end run around the concern a lot of business executives are feeling—whether their employees will be able to get to work that week. And it will give everyone a chance to deal with problems in their own lives (if kids can't get to school; if elderly parents are without heat and so on).

Obviously, this week off would not apply to the front-line executives who must be in place to assess problems and coordinate resumption efforts. Nor will it apply to the technology folks in the trenches working on fixes.

The federal government is already considering moving the New Year's holiday from Friday, Dec. 31, 1999, to Monday, Jan. 3, 2000, for this very reason. Personally, I don't think one extra day is going to buy us enough time.

While taking a national Y2K Week may seem extravagant, it's not. Given all that could go wrong, we may end up with the same lack of output even if we try to conduct business as usual. Besides, how often does a new millennium come around? Doesn't it merit a little extra attention?

I know most CIOs think this is a bad idea; at the recent CIO Enterprise Value Retreat in Tucson, Ariz., 81 percent of over 200 IT and business executives surveyed said businesses should not shut down. But 12 percent supported the idea, and I'll bet that number grows the closer we get to the end of the year.

And think of this: If Y2K Week happens, the resumption of life as we know it will occur on 1/10/00—the perfect date to begin the digital millennium!

Do you support Y2K Week? I'd love to know why or why not. Drop me a line.

Abbie Lundberg
lundberg@cio.com

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In Box

COMMUNITY TIES

Some people believe the year 2000 computer problem is a crisis waiting in the wings. Others consider it much ado about nothing. Those of us in the middle believe that there will be problems but that we will ride them out on a sea of sustainable cooperation. We see Y2K as a wonderful opportunity for building community.

As people advance beyond the awareness, denial and anger stages of Y2K, they will reach a decision point. They can choose to ignore the problem, panic and head for the hills or turn the year 2000 into a collective opportunity.

Ignoring the problem is a dangerous option. If bad things do happen—and we all know this is a real possibility—those who aren't prepared will be blindsided by inconveniences or worse.

The other extreme is also not a viable option. There simply is not enough food, medicine, blankets, water, raw materials, solar panels, generators and other essentials for everyone to stockpile. If a crisis occurs, this will create a world of bunkered-in haves and desperate have-nots. Even if Y2K is just a blip, hoarding creates the very problems it tries to address. There will be shortages galore and possibly panic.

The third and most logical choice is to build sustainable year 2000 plans within your community, thereby ensuring that everyone—the poor, the sick, the elderly and all the rest of us—gets through the millennial transition. This option works for those who believe the problem is extremely serious, those who have staked out the middle ground and those who think it's no big deal. And no one gets hurt.

Even if Y2K results in only minor inconveniences, we will have established new relationships in our communities in preparation for other challenges like hurricanes, floods and earthquakes or something as mundane as a zoning issue. If the Y2K problem becomes serious, however, the community knows that everyone is prepared.

But preparations must begin now. The first step is to create a Y2K community task force involving local leaders, elected officials, businesspeople and other concerned parties. CIOs, with their knowledge of both the technology issues and the broader implications of Y2K, can provide valuable contributions to their communities' efforts.

Once the team is organized and has defined a mission, it will build awareness by working with other local groups, partnering with the private and public sectors to research community readiness and creating a millennium transition plan. A guide for creating such a group can be found at *www.dfiy2k.org*.

As localities mobilize to deal with the year 2000 issue, consider the wonderful opportunities this presents in building a stronger community. I have met more people in my community in the past two months than in my first nine years here. Sustaining this group, no matter what happens in 2000, is now our goal. I hope you will all join us in this journey. It is really the only logical choice.

William Ulrich

Mr. Ulrich is president of Tactical Strategy Group Inc., executive vice president of Triaxsys Research LLC and director of Data Fitness Initiative & Coalition. He is also involved in the Santa Cruz, Calif., community group.

CIO Involvement in Y2K Community Planning Efforts

Involved	9%
Not involved but I should be	43%
Not involved/ it's not important	48%

SOURCE: CIO KNOWPULSE POLL OF OVER 200 BUSINESS AND TECHNOLOGY EXECUTIVES, FEBRUARY 1999

Finding It Online

Resources for Y2K Community Planning

www.berkana.org
www.cassandraproject.org
www.co-intelligence.org
www.CY@KR.org
www.dfiy2k.org
www.resilientcommunities.org
www.Y2Kcommunity.org
www.wild2K.org

CHIP CONCERNS

In the "The Bionic Man" [Trendlines, *CIO* Section 1, Jan. 15, 1999] you wrote about Kevin Warwick, who had a transponder implanted in his body. He said the most important lesson learned was "It made me realize how the human body is just another being—not so special."

I'm shocked and hope I misunderstood the quote. Human beings are indeed very special and are wonderfully created! We are more important than plants and animals, although we are to take care of them. We are certainly more important than computers. We may become psychologically linked to them, but never forget who created computers. The created are not greater than their creator.

Doug Juhlin
Systems Analyst
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CORRECTION

In a recent story on The Mitre Corp., we inadvertently misstated the company's 1997 revenues ["Common Knowledge," *CIO* Section 1, Feb. 1, 1999]. Mitre earned $488 million in 1997. We regret the error.

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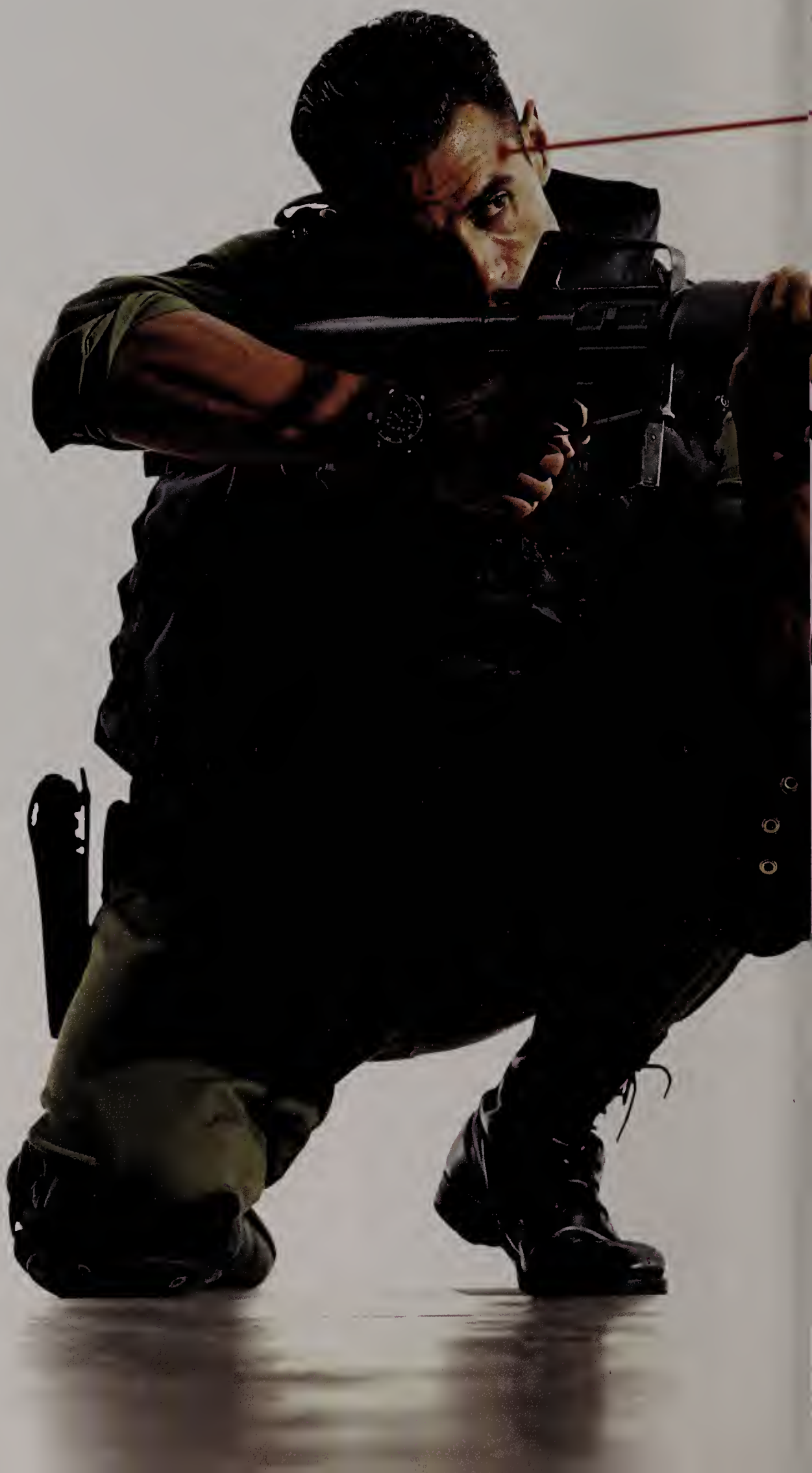

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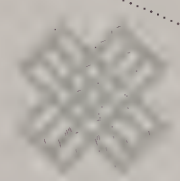

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Who's watching your network

Publisher's Note

The market is abuzz about Linux, the open source operating system created in 1991 by Linus Torvalds. International Data Corp. pegs Linux's worldwide server share at 17 percent and claims its user base, estimated at 10 million, is growing at 50 percent annually—a healthy growth rate. Compaq, Hewlett-Packard, IBM, Informix, Lotus, Novell and scores of other software and hardware vendors are working on products for the operating system. Linux proponents hope that within 18 to 24 months the software will compete seriously with Microsoft Corp.'s Windows 2000 (a.k.a. Windows NT).

Critics of Linux say it is difficult to install, has yet to prove itself in a multivendor, enterprise environment and offers sparse commercial support. Supporters highlight research that shows Linux scales better than Windows NT, and they point to the millions of Linux users on the Internet who offer free support and advice.

CIOs counter *free* with two words: trust and accountability. You implicitly trust a vendor to deliver a product or service as promised. And if the product or service is of poor quality or fails, you have recourse: a lawsuit. Right now Linux is more Woodstock than Main Street. There aren't enough vendors dedicated to the operating system, and it's kind of hard to sue the surfer in Venice Beach, Calif., who gives you poor Linux advice. What will it take, then, for CIOs to take Linux seriously?

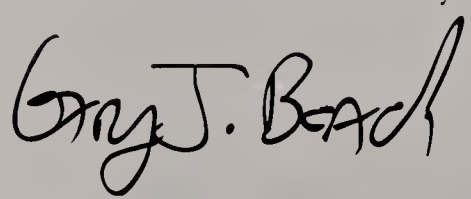
At *CIO*'s recent Enterprise Value Retreat, I asked the CIO of a major financial services firm his view on the operating system. He said, "Linux will get my attention when a major vendor announces it's going to fully certify the software." By full certification he means that Linux will run not only on the server as advertised but more important with other applications in the enterprise. Currently, no vendor makes this claim. Senior Writer Derek Slater explores the issues involved with open source software in the enterprise in his story "Free Radicals" on Page 62.

CIOs, not the sneaker-wearing programmers, will determine the fate of Linux. Its vocal supporters deserve credit for getting software and hardware vendors to port to Linux. That's the easy part. The hard part is getting those same vendors to commit. Vendors need to see a real economic opportunity (Show me the money!) or the operating system will be eternally assigned to the "we'll get around to it" department.

So what's next for Linux? What should CIOs do?

Pick a department within your enterprise and create a controlled environment to put Linux through its paces. Find out for yourself how scalable, robust and crash-proof the operating system is.

Linux or Windows? What's your view? Send an e-mail to my address listed below.



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Trendlines

NEWS, INSIGHT, HUMOR, REVIEWS

Edited by David Rosenbaum

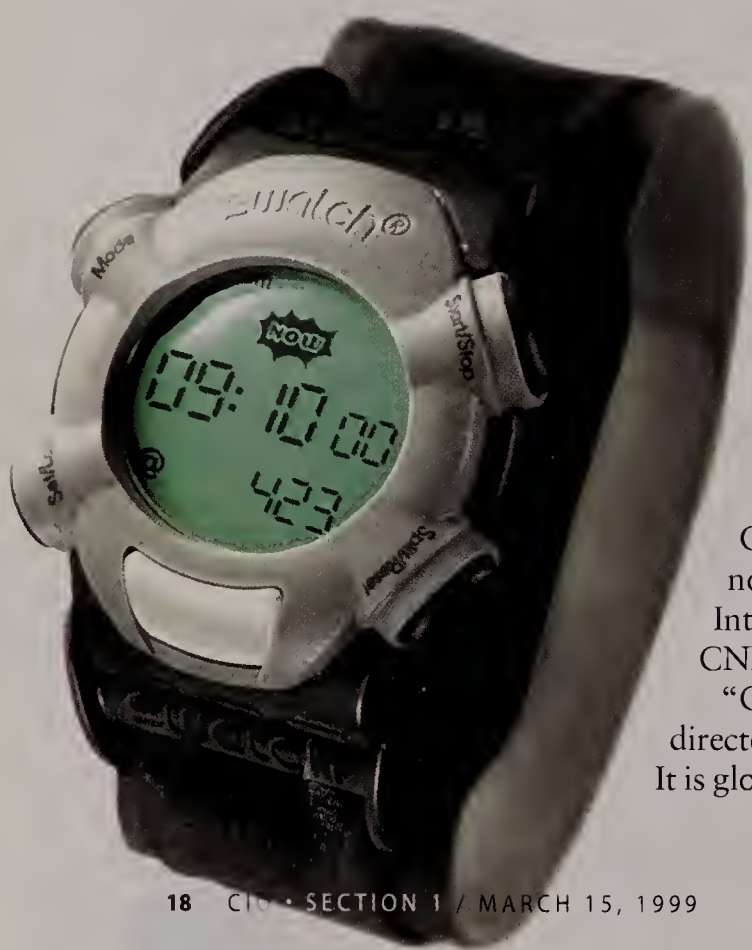
How Push Got Shoved

HIGH TERMINOLOGY When vendors start knocking each other over to jump off the push technology bandwagon, you know the thrill is gone.

In the March 15, 1997, issue of *CIO*, Caravelle Inc., Tibco Software Inc. and BroadVision Inc. all boasted about push products that delivered filtered, customized Web-based information to your desktop (see "Playing Fetch," Page 22). This year, those vendors still ply the Web, but they've all backed away from the push label in light of the negative publicity about push technology in general (it was obnoxious; it crashed systems; it didn't work because people didn't have their computers turned on 24/7 and so on) and push technology companies in particular—like PointCast Inc., the Silicon Valley company that famously failed to live up to its hype.

Today Caravelle (which was purchased by New York City-based Avesta Technologies Inc. in March 1998) markets "service-level management solutions" to companies that operate critical extranet and e-commerce sites. "We are concentrating more in the area of ensuring that the IT environment is available and performing," says Lynda Partner, Avesta's vice president of marketing. The company's flagship product suite is Trinity, which includes IPnetWatcher: Web-based management software that monitors the network components and applications involved in providing secure Web services. "The software delivers proactive alerts to let people know they have problems within the IT infrastructure before the electronic store shuts down," Partner says.

Yes, those alerts are pushed to the desktop, but doesn't proactive sound better these days? *Continued on Page 20*



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Introduced last fall at MIT Media Lab's Junior Summit (which drew 100 youngsters from across the globe and was sponsored by The Swatch Group, Citibank and The Lego Group, among others), a day in Internet Time begins at 000 Swatch Beats, which is midnight at Swatch headquarters in Biel, Switzerland, the self-proclaimed meridian for Internet Time. (See ya later, Greenwich.) Each beat is equivalent to 1 minute 26.4 seconds, so 500 would be noon. At the Junior Summit, Swatch handed out about 100 watches that tell Internet Time. They can be set either at the Swatch Web site (*www.swatch.com*) or at CNN's (*www.cnn.com*).

"Cyberspace has no seasons and no night and day," says Nicholas Negroponte, director of the MIT Media Lab in Cambridge, Mass. "Internet Time is not geopolitical. It is global. In the future, for many people, real-time will be Internet Time."

–David Rosenbaum

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Trendlines

Continued from Page 18

Engineers at Tibco in Palo Alto, Calif., are busy rolling out components of an active enterprise server designed to integrate multiple applications across a corporate network. With Tib/ActiveEnterprise, companies can link information from a mainframe-based ERP system to a midrange database application and deliver it to a Web browser on a desktop, according to Fred Meyer, Tibco's vice president of product management.

Yes, information is pushed from back-end systems to end users, but Meyer emphasizes the "integration" of Tibco's products, so much nicer-sounding than push.

Pehong Chen, president and CEO of BroadVision in Redwood City, Calif., never cared for the push label. "It was the kind of technology looking for a problem to solve," he says. Today BroadVision instead concentrates on the market for "extended relationship management tools." The company's One-To-One suite of products is designed to deliver customized, individual information via Internet applications. In its marketing brochures, BroadVision touts the ability of its technology to support personalized channels of information. A brokerage company, for example, could deliver personal account information to a customer on a secure Web site.

Which sounds a lot like push, but don't tell Chen.

Indeed, it sounds like push technology may not be dead after all. But as a marketing pitch, hey, it's history.

–Megan Santosus

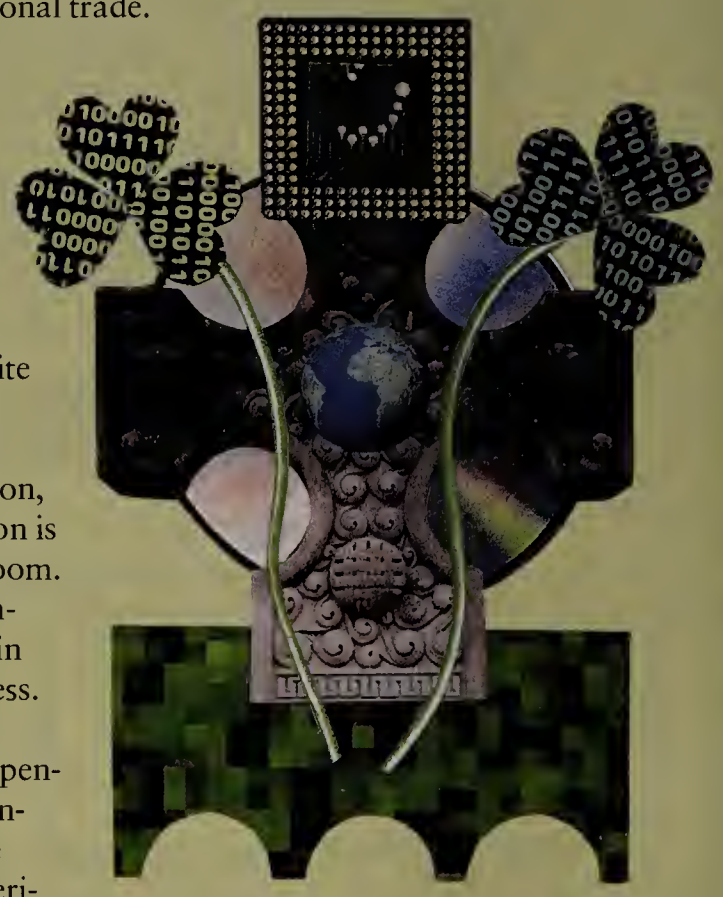
How Green Is My Software

FOREIGN DESK In the heart of the "Hibernian metropolis," as James Joyce once called his beloved Dublin, something is brewing, and it's not just the Guinness. Irish IT, which in 1997 accounted for roughly 10 percent (approximately $6.9 billion) of the Republic's GNP, is catapulting the country toward a significant global software position.

Indeed, as Ireland celebrates St. Patrick's Day this month, the wee small island (population 3.6 million, or less than half of Los Angeles County's) is second only to the United States as a per capita software exporter.

Over the past four years, Ireland's software industry has grown like Topsy. It currently employs more than 20,000 people, a little less than 2 percent of the country's total workforce. This figure is expected to double by 2002, according to the Dublin-based Irish Software Association (ISA). And in January 1998, Austin, Texas-based Dell Computer Corp. announced the expansion of its sites in Limerick and Bray, which the company says will produce 3,000 jobs over the next five years.

This greening of Irish IT was part of the government's plan to establish Ireland as a center for international trade. Ireland has kept corporate income tax rates low (10 percent as compared with the United States' 40 percent or Germany's 45 percent), and it has offered special incentives to companies interested in doing business on the island, such as capital grants toward site development and cofunding employee training programs.



According to Michael Hannon, an executive with ISA, education is the key driver in Ireland's IT boom. In the '60s and '70s, the government funded degree programs in engineering, science and business. The result is a country with a highly qualified, relatively inexpensive workforce. (The average annual salary of an Irish software engineer with five years of experience is $52,000 as compared with more than $70,000 last year for a similarly experienced engineer in Dallas.) This is a package that's irresistible to foreign companies. Intel Corp., for example, opened its largest site outside the United States in 1989 in the city of Leixlip, in County Kildare, just west of Dublin.

But foreign-owned businesses are just part of the Irish success story. Hannon reports that today 625 of the 735-plus software operations in the Republic are Irish-owned.

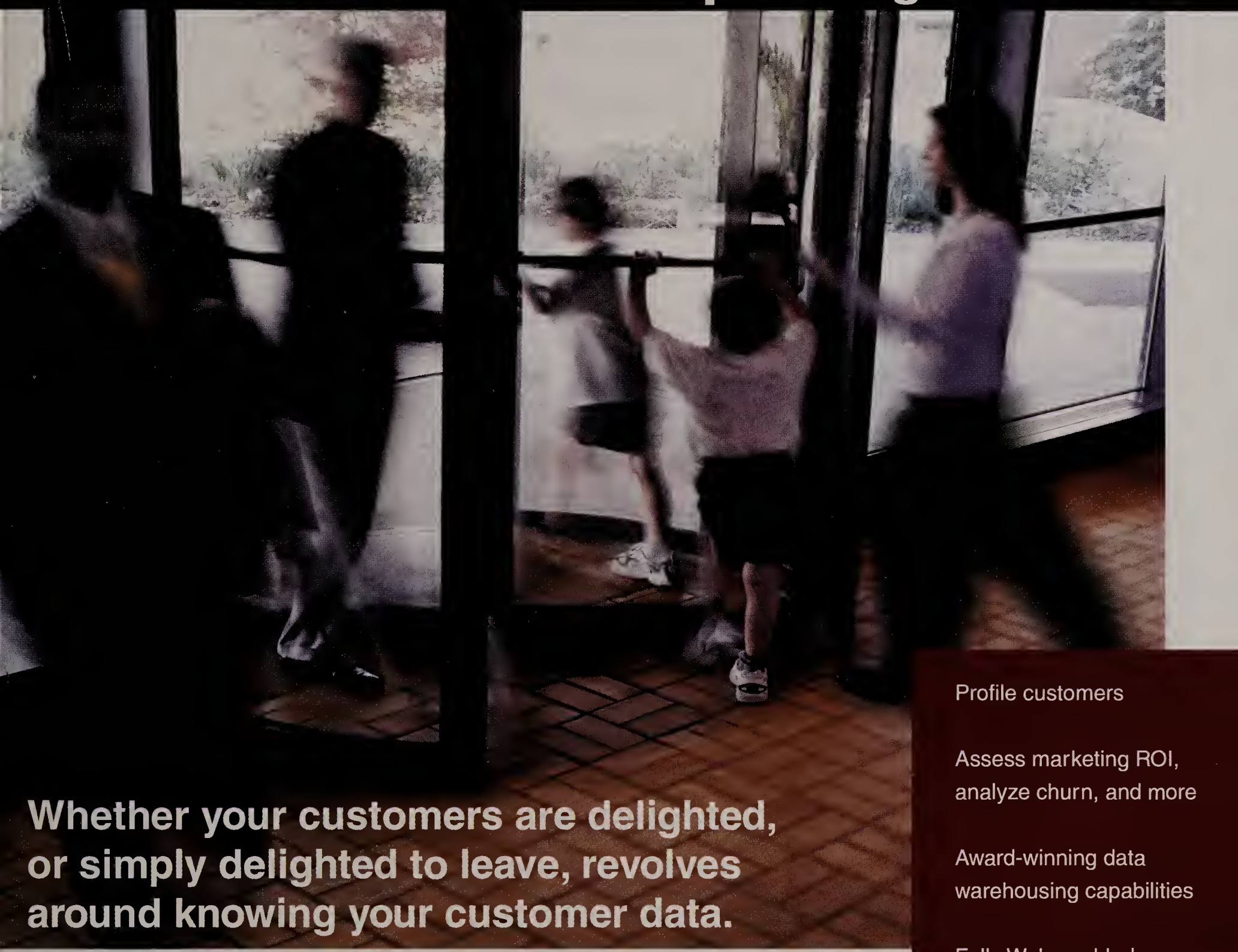
Though highly qualified people continue to graduate from Irish universities, Ireland is beginning to feel the bite of the all-too-familiar staffing crisis. If the Emerald Isle's boom is to continue into the 21st century, says Hannon, the government must continue to support it with inventive, creative policies.

And if the past is any predictor, it probably will.

–Meridith Levinson

ILLUSTRATION BY JAMIE HOGAN

Customer Relationship Management



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Trendlines

The Big Picture

WEB DREAMS On March 31, Denver-based W3Networks Inc. is planning to roll out a new Internet. Or, as the company motto has it, "The Internet for the Rest of Us."

What this means in practice is that W3Networks founder and CEO Steve Bonneau has been buying up domain names like they're going out of style. (Which, of course, they are.) He now has more than 3,000, each with a W3 prefix. For example, there's W3CarSpeakers.com, W3AlternativeMusic.com and W3ChildrensSocks.com. Instead of using a search engine, you go to *www.W3.com*, enter W3ChildrensSocks and the W3 network (thanks to its partnership with the search engine company Inktomi Corp.) produces a listing of the top socks sites.

The idea, says Bonneau, is to make the Web more intuitive. Instead of hunting through page after page of loosely associated listings, W3Networks provides an Internet Yellow Pages with the added value of one-stop shopping. Soon it will record your credit card numbers so that you won't have to type them in each time you buy something, thereby becoming your personal shopper and your shopping cart. For this service, it will receive from the vendors a negotiated percentage (from 2 percent to 20 percent) of each transaction.

Shopping is just the first rabbit W3Networks is pulling out of its hat. The plan is for free e-mail to follow and after that increasingly personalized functionalities. Bonneau says he got the idea for W3Networks when he was looking for Blue Spruce seedlings on the Web (he wanted to plant some) and wound up reading about their history throughout the ages.

Right now, W3Networks has a modest advertising budget of $10 million to $15 million to establish its identity. Bonneau calls branding the biggest hump W3Networks must surmount to succeed, followed closely by ensuring customer satisfaction. To that end, he's making site management a strategic priority.

Bonneau says his ultimate goal is to marry content with access, which (although he simply smiles when it's suggested) makes it sound as if his ultimate goal is to be America Online.

We shall see.

–David Rosenbaum

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STORAGE

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The Value of Information:

The Rise of Information-Based Management

WHAT YOU DON'T KNOW, indeed, can hurt you. But business managers are now recognizing an equally important corollary: What you do know can provide you with a competitive advantage and boost your organization's bottom line. And the more you know the better your chances of success.

Business management visionary Peter Drucker affirmed the connection between information and success in his book *Post-Capitalist Society*, declaring: "The basic economic resource—the means of production—is no longer capital, nor natural resources nor labor. It is and will be knowledge." Corporate data and information are the raw materials of knowledge.

Successful organizations today typically are those most effective at collecting, storing, accessing, and distributing information. To these organizations, data and information have emerged as valuable corporate assets to be managed, leveraged, and protected. For example:

- The Ritz Carlton Hotel collects information on every personal encounter between its staff and a guest, building a huge database of information that enables it to deliver better, more personalized customer service.
- Federal Express tracks and stores data on the progress of every package it ships, allowing customer service staff and customers themselves to access and analyze that data.
- Wal-Mart builds a multi-terabyte data warehouse to help managers, merchandisers, and suppliers monitor and analyze the flow of products through the stores and to ensure that the right products are in the right place at the right time in the right quantities.

With the advent of the Internet, corporate intranets, and multi-company extranets, companies can now effectively collect and disseminate more information than ever

"Managers increasingly see company data as corporate crown jewels . . . If data is lost or . . . access to critical data resources is delayed long enough, the very future of the organization is brought into question."

Greg Meland,

President/CEO, Datalink

before. Between data warehouses and the Web, organizations have the means to both store and distribute massive amounts of information.

Given the growing amounts of corporate data and the critical role data increasingly plays in the organization's bottom line performance, managers are recognizing as crucial the need to effectively store and protect corporate information assets. "Managers increasingly see company data as corporate crown jewels," observes Greg Meland, president/CEO, Datalink, a leading information management solutions provider. "If data is lost or access to data is delayed, the organization's bottom line suffers. If the loss of data is severe enough or if access to critical data resources is delayed long enough, the very future of the organization is brought into question," adds Meland.

This special section examines the emergence of data as a critical corporate asset that must be managed, leveraged, and protected like other valuable corporate assets. It explores the role of storage in managing the data-information asset. It then reviews effective storage management strategies that address the scalability, availability, and recoverability of the corporate data-information asset. It also presents actual corporate storage strategies.

The Scope of the Data Challenge

"Traditionally, top management has been charged with cultivating, leveraging, and protecting the company's most valuable assets," notes Meland. In the past, these assets typically involved the organization's facilities and equipment, raw materials, finished goods, intellectual property such as patents, and personnel.

Today, however, managers suddenly find the organization's data-information asset at the top of the list. Companies may shed facilities, inventory, and even workers as they outsource anything and everything. But they can't shed their data. It is the information about customers, markets, products, services, business processes, and such that make the company uniquely what it is. As a result, top managers are increasingly concerning themselves with the storage of data as they manage, leverage, and protect this valuable corporate asset.

The corporate data asset is worthless if people don't use it to advance the organization's objectives.

The data-information asset, already large, is growing fast. The size of the corporate data asset, Meland reports, is being driven by a host of factors:

- New applications—core business applications such as enterprise resource planning (ERP) systems, supply chain management, and front-office solutions (customer management, sales automation, marketing) generate massive amounts of transaction and support data.
- New data types—e-mail, images, audio and video represent new types of data, some of which are quite large, that must be stored, managed, and protected.
- More information workers—more users are working with data, combining and enhancing it in myriad ways to create new information, dramatically increasing the amount of data to be stored, managed, and protected.
- New data distribution capabilities—Internet, intranets, and extranets expand the organization's data reach, enabling it to collect data from a global network of data sources and disseminate it across an equally wide area.
- New economics—steadily decreasing costs of storing (cost per megabyte of storage) and distributing data (cost of communications bandwidth) combined with the increased value of the data asset allows organizations to store more information in more places than ever before.

These forces together with normal growth of data have led to a surge in the storage of data. International Data Corp. (IDC) projects 3 million terabytes (TB) of data storage by 2000, up from 500,000TB in 1997. By 2002, when data warehouses average 6TB, as some analysts project, the amount of data that organizations need to store, manage, and protect will be zooming off the charts.

Leveraging the Information Asset

The corporate data-information asset is worthless if people don't use it to advance the organization's objectives. The value comes when organizations leverage the information asset and

align it with their business strategies.

The emergence of data warehouses and data marts enable managers to align their business strategies with their information systems through access to data stored and organized in ways useful to business managers and workers. The Palo Alto Management Group (PAMG), after conducting in-depth interviews with 375 companies, projects the total data warehousing market (hardware, software, and services) to hit $113 billion by 2002, up from $15 billion in 1997.

In the data warehouse or data mart, organizations collect, organize, and make accessible vast amounts of corporate data. It is no longer unusual for organizations to build and operate multi-terabyte-size data warehouses as managers recognize how much value can be extracted from corporate data. The average data warehouse today contains 272 gigabytes (GB) of data. PAMG projects a 24-fold increase to 6.5TB in the size of the average data warehouse over the next three years.

More important, the corporate information asset represented by the data warehouse will evolve from something used by a relatively small number of analysts, managers, and information workers to a widely leveraged information asset used by workers, suppliers, partners, customers, and even the public at large. Today, the typical data warehouse supports 2,200 users, according to PAMG. By 2002 it could support 100,000 users as organizations distribute their information beyond their immediate corporate boundaries. At the same time, the organization's workers will be collecting information from the data resources of others and making it part of the organization's own data asset.

Through online analytical processing (OLAP), data mining initiatives, business intelligence strategies, analytical applications, and knowledge management practices, organizations will increasingly cultivate and leverage their data assets to produce greater and greater business returns. Initiatives such as these represent effective strategies to make the product of information systems—the data—valuable in the particular business endeavor.

With the emergence of data as a valuable corporate asset, storage management becomes a top business priority.

For instance, IDC measured the analytical application market alone at $1 billion in 1997. The research firm projects it will hit $2.8 billion by 2001 and $3.6 billion by 2002. The growth of analytical applications—packaged data access and analysis tools for use by business managers and workers—reflects the efforts by management to align business strategies with information systems and leverage the data asset.

The Storage Management Challenge

With the emergence of data as a valuable corporate asset, storage management becomes a top business priority. Executives charged with the care and development of key corporate assets now must concern themselves with storage strategies and storage issues. This represents a significant shift from past practices.

In the past, storage was considered "a tactical technical process relegated to technical staff, whose job was to sort through the intricacies of how data assets were stored and retrieved, distributed, and backed up," Meland recalls. The technical staff would also monitor storage use, perform capacity planning, and generally manage the data storage process. As a percentage of the organization's total information technology budget, storage was a significant, but not an overwhelming piece. Compared to the cost of the organization's host systems and servers, storage costs seemed in line with its tactical role.

With data recognized as a valuable corporate asset, storage management now takes on a strategic role. And given the soaring volumes of storage, the organization's investment in storage—despite annual decreases in the cost per megabyte—now rivals or exceeds the investment in systems and servers, often accounting for 50 percent or more of the data center budget.

With that level of investment at stake and the critical importance of the organization's data asset, it is no surprise storage management has attracted the attention of the organization's top executives. Storage management decisions directly affect the bottom line.

Between managing storage for top performance and cost-effectiveness while leveraging and protecting the organization's data assets, managers face a number of key storage management challenges:

- **Scalability**—the need to keep pace with the rapidly increasing demand for more storage. Organizations that use hundreds of gigabytes of storage this year will require terabytes of storage in just a few years.
- **Accessibility/High Availability**—the need to ensure access to the data assets whenever and wherever needed. When problems interfere with access and availability, the bottom line suffers through the loss of productivity and reduced customer service.
- **Recoverability**—the need to ensure that critical data is protected even in the face of a range of disasters, from fire and flood to human

error and intentional damage. Up-to-date copies of data must be stored in multiple locations where they can be used to enable the rapid recovery of lost or damaged data.

Of course, not every single piece of data needs to be treated like a critical asset. But surprisingly, more data than an executive might initially suspect may be critical. For example, how many people a few years ago would have considered e-mail as critical data that needed to be kept available and backed up? Yet today, many companies would suffer if e-mail data were lost. Crucial customer communications, valuable sales information, strategic planning ideas captured in memos, and sensitive data are increasingly communicated via e-mail. Much of this data must be protected and kept available to sales and customer support personnel.

In addition, "storage management entails a number of vexing technical challenges," notes Scott Robinson, Datalink vice president of engineering. These include:

- Vast amounts of data to be physically stored and backed up
- Vast amounts of data that clog the storage channels and consume large chunks of the organization's network bandwidth
- Heterogeneous corporate systems and networking environments consisting of a wide assortment of hosts, servers, client systems, and networks
- User demand for fast, online, nearly real-time access to data
- Around-the-clock operations that eliminate overnight windows for backup and storage maintenance (There is no overnight on the Internet—systems must be online 24/7.)

To meet these challenges, organizations need to develop a set of storage management strategies as part of an overall information management strategy. Given the size of the challenges and all that is at stake in leveraging and protecting the data asset, high-level managers should participate in the process. "Storage management is too important to be left solely to the technical staff," adds Meland.

The following sections examine specific strategies for scalability, high availability, and recoverability.

SCALABILITY STRATEGY

Genome Sequencing Center

Washington
WASHINGTON·UNIVERSITY·IN·ST·LOUIS
School of Medicine

BACKGROUND The Genome Sequencing Center (GSC) is part of Washington University's School of Medicine. Funded by a major grant from the National Institutes of Health, GSC is charged with systematically sequencing the human genome—determining the order of the 3 billion pairs of chemical bases that make up human DNA—using techniques, tools, and informatics it has developed. GSC had three people in 1989; today it has 250. Its finished output in 1989 amounted to 20,000 units of work; today it generates 100 million units and is rapidly pushing toward 200 million units.

PROBLEM GSC needs to store its output as accessible information. Starting with 500MB of storage in 1989, the center had 2.5TB of storage by the end of 1998. Although it projects storage growth of 1TB annually, it has continually decreased production costs thereby increasing its finished output and necessitating ever more storage. The primary raw data is stored as 40MB image files and 200K information files. At its current rate, the center generates 80,000 information files each week and 1,350 image files. All this must be stored and backed up. GSC has been storing its data in RAID 5 disk arrays connected to multiple, distributed servers. This approach to storage has been difficult to scale, manage, and backup.

SOLUTION To address the scalability problem, GSC considered hierarchical storage management (HSM), an automated approach to offline data archiving, but found the HSM approach did not fit with its particular archiving requirements. Working with Datalink, the center opted instead to prepare to gradually move to a storage area network by implementing a high-availability server cluster with a terabyte of RAID 5 storage, which can be easily scaled to 8TB as needed. It is also implementing centralized StorageTek enterprise tape backup.

RESULTS GSC will be able to handle another terabyte of storage and easily provide additional storage as required, reports LaDeana Hillier, GSC director of informatics. At the same time, it will be able to more efficiently administer and back up its information and ensure high availability of the information. Finally, it will be positioned to migrate to a storage area network for even greater storage scalability, manageability, and performance.

Scalability Strategies—Managing Massive Amounts of Information

Fueled by soaring user and application requirements and falling costs, data storage needs are increasing

exponentially. As previously noted, IDC projects total storage to hit 3 million TB by the turn of the century. At the current rate of growth, the amount of storage will significantly exceed that mark by 2002.

In the past, organizations simply attached more disk storage to each server as demand grew. This was a fast and simple approach to the problem, but resulted in gigabytes of storage scattered throughout the organization.

This approach, often referred to in the past as DASD (direct access storage devices) and now as JBOD (just a bunch of disks), suffers from several drawbacks as the need for storage grows. First, the storage is physically and logically scattered throughout the organization, making it very difficult to maintain and support. Technicians and administrators must rush around to each server and disk cabinet as they manage and maintain the storage. Second, JBOD offers no protection against the loss of data or ability to ensure the high availability of data, which is a growing concern as data plays an increasingly critical role in the performance of the organization.

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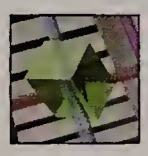


With widespread deployment of fast networks, organizations are increasingly centralizing the management of their storage, logically as well as often physically.

RAID ASCENDANCY

Instead of JBOD, organizations are turning to RAID (redundant array of independent disks), a collection of disk drives used in a coordinated fashion to achieve greater reliability and performance. According to Disk/Trend, a leading storage research firm, as much as 80 percent of all systems today include RAID storage. By 2001 IDC projects sales of 361,300TB in the RAID format compared to 50,000TB in the JBOD format. Among the hot selling open system platforms, IDC projects RAID to grow at a 135 percent CAGR through 2001 on the Windows NT platform and at an 87 percent CAGR for UNIX platforms. JBOD will be relegated to situations with less critical data.

"RAID offers a number of advantages in the areas of performance, manageability, and high availability," suggests Dennis Cindrich, StorageTek vice president and general manager, Client Server Disk. For instance, various RAID formats are optimized for different types of applications, such as storing large multimedia images. Certain RAID formats, because of the way they spread data across the multiple disks in the array, can provide increased throughput or improved performance for different types of data and access.

In terms of management and maintainability, RAID systems support such features as hot swappable disks. This allows technicians to replace a failed disk drive with a new drive without bringing down the system. Once the drive is replaced, the RAID system automatically rebuilds the data that resided on the failed drive. This ensures continued high availability of the data while reducing the time and costs associated with the replacement of failed drives.

"There are two types of RAID: hardware-based and software-based," Cindrich explains. The most feature-rich and effective RAID is hardware-based RAID, where the intelligence that coordinates the storage process is built into the physical RAID controller. Software RAID, in which the intelligence is built into the server or network operating system, can be used in conjunction with JBOD to achieve rudimentary RAID functionality. Software RAID costs less initially, but the reduced functionality, such as lack of hot-swap capability, often results in a significantly higher overall cost of ownership.

CENTRALIZED MANAGEMENT

But RAID itself only begins to address the storage scalability issue. With widespread deployment of fast networks, organizations are increasingly centralizing the management of their storage, logically as well as often physically.

"Centralized enterprise storage management allows a small team of administrators to manage RAID storage across the corporate network," explains Cindrich. Administrators can manage backups, redistribute loads, tune performance, and perform other tasks without having to traipse across the enterprise, visiting individual storage devices (except when actual drives must be replaced or additional drives installed). As a result, it will require fewer adminis-

trators to manage increasingly large amounts of storage, resulting in significant cost savings.

As long as the cost per megabyte of storage continues to drop—it has been dropping about 60 percent per year—organizations will be able to accommodate increased demands for storage by adding more RAID and JBOD online. These cost decreases, which result from the ability to pack more data into the same space, will continue at least through 2005, when the size of the dot of stored data will become too small to maintain its electromagnetic orientation, according to Disk/Trend. Centralized management combined with decreasing costs will enable organizations to effectively manage tens of terabytes or more of data.

Accessibility/High-Availability Strategies—Leveraging Information Assets

The value of the data asset, as noted above, is directly proportional to its use. Unlike cash or gold or real estate, data has no general market value. Data and information not used to advance the organization's objectives are worthless.

Similarly, when information workers—who represent an increasing proportion of the workforce—are unable to access information, productivity suffers or halts altogether. In some of our most dynamic industries, such as financial services, information workers make up virtually the entire workforce. When data is unavailable, productivity quickly slows.

As a result, managers concerned with worker productivity and customer service suddenly find themselves paying attention to high-availability storage issues. High-availability storage addresses the need to store data so that it is available to workers whenever they need it.

THE RAID SOLUTION

"A key benefit of RAID is high availability," explains Robinson. RAID, which comes in numerous formats designated by number, such as RAID 3 or RAID 5, ensures the availability of data even if one of the drives in the disk array fails, which invariably occurs. RAID is achieved through either disk mirroring (RAID 1) or other forms of RAID, typically RAID 3 and RAID 5. In RAID mirroring, data stored on half the disks in the array are automatically copied (mirrored) onto the disks making up the other half of the array. In RAID 3 and RAID 5, data is spread across multiple disks in the array. Parity information is automatically stored on one disk in the array and can be used in the automatic reconstruction of lost data in the event of a disk failure. If the parity information is lost, it can be reconstructed from the existing data.

There is a cost component to RAID high-availability solutions, which managers must bear in mind as they determine which RAID strategy to use for the storage of a given set of data. RAID mirroring, for example, provides higher performance for certain applications, but requires twice the amount of disk capacity to accommodate both the initial copy of the data and the mirrored copy. This doubles the investment in disk drives. When a drive

HIGH-AVAILABILITY STRATEGY

Primark Corporation

BACKGROUND Primark Corporation, through its financial information division, is a leading provider of company intelligence delivered via advanced online and CD-ROM-based research tools. Primark provides its customers with access to a broad and deep range of proprietary and third-party global business and financial information including extensive filings of public companies, private company data, investment analyst reports, financial and management information on thousands of companies worldwide, and business news from over 2500 publications and news services.

PROBLEM Primark must maintain a massive amount of information online, about 2.5 TB, and make it immediately available to customers around the clock and around the world. In addition, its data volume is increasing at a rate of 0.5 TB per year or more. With contracts stipulating that the information be available at any time, Primark must ensure the high availability of all its stored data.

SOLUTION The company explored optical storage in an HSM configuration, but the solution failed to deliver the necessary performance. "With the cost of disk coming down, hard drive storage made the most sense," explains Greg Burge, senior technologist. Working with Datalink, Primark selected an easily expandable StorageTek RAID 5 storage subsystem. The use of RAID 5, including a hot spare, ensures that all data remains accessible even in the face of the simultaneous failure of any two disks. Using software it developed in-house, Primark also mirrors the entire server and RAID 5 storage system for complete redundancy.

RESULTS Since installing the storage system, Primark customers have not experienced any periods where the data was unavailable due to a disk drive or server failure. When the company experienced a massive power failure, it was able to quickly resume service without the loss of any data, Burge reports.

fails, the system automatically switches to the mirrored copy. Once technicians replace the failed drive, the system automatically loads the data onto the new drive from its working counterpart.

"In today's highest performance RAID systems, the RAID level used is less important than other architectural features like bus design, cache scheme and cache algorithms, and sophistication of host connection interfaces," explains Robinson.

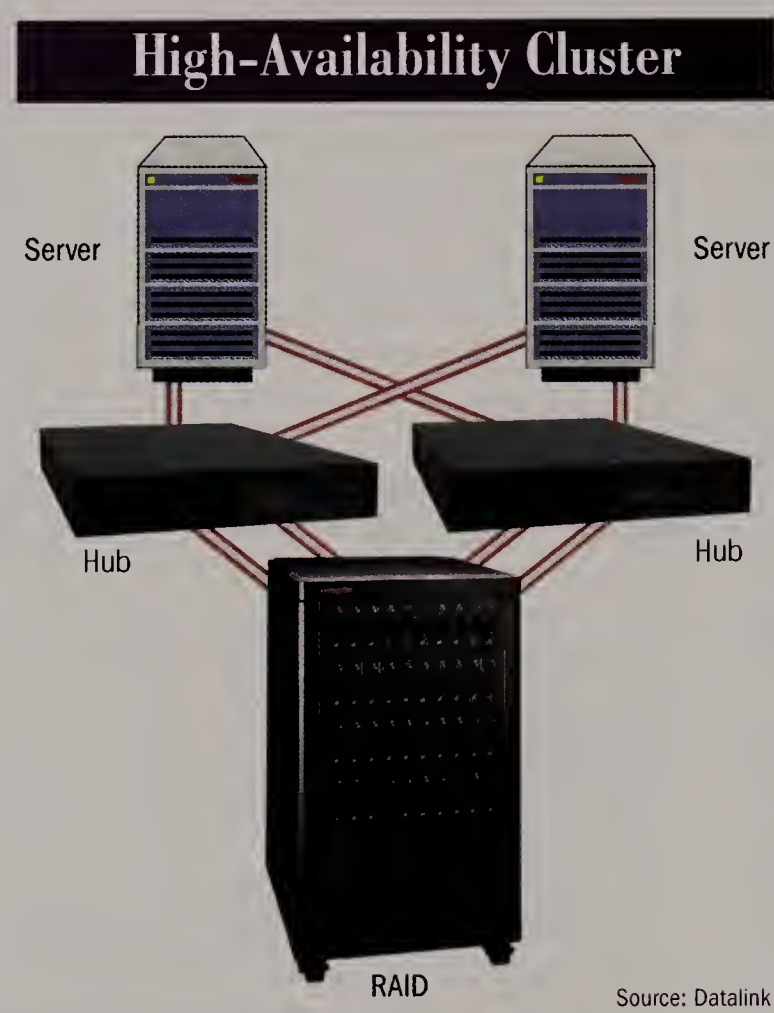
"The RAID solutions that rely on parity information require only one disk out of every four or five to store the parity information," Robinson continues. This translates into a 25 percent to 33 percent increase in the number of drives required. As such, it presents a lower cost solution versus mirroring.

SERVER CLUSTERS

Data may become unavailable because a server fails rather than a disk drive. For complete high availability, managers should consider server clusters in conjunction with RAID storage. In server clusters, two servers coordinate their efforts. In the event one server fails, the other server in the cluster can pick up the workload and provide access to the failed server's stored data. "Server clusters use advanced RAID storage for the utmost in data availability," adds Robinson.

Increasingly, organizations are establishing separate pools of RAID storage to support server clusters. These pools of storage devices, when collected on a separate subnetwork, are referred to as a storage area network (SAN), which has emerged as the most promising of the new approaches to storage. [see Advanced Storage Management Solutions on page 9].

Given that availability is critical to fully leveraging the value of the organization's data asset, managers must establish priorities for applications and data. Based on these priorities, they can assign the correct high-availability strategy to a given application or data, depending on cost and performance. It is likely that an organization will use a mix of strategies involving JBOD, software RAID, hardware RAID, server clusters, and eventually SANs.



In a server cluster, the introduction of redundant hubs improves the fault isolation and reliability of the cluster.

Recoverability Strategies—Protecting Information Assets Against Disaster

Recoverability is not the same as high availability. High availability ensures that your workers can access your data assets despite normal disk drive and server failures. Recoverability ensures that the organization's data is safe and can be quickly restored in the event of a disaster that puts the primary information system out of action. This could happen as the result of any of a number of events, natural and man-made, from hurricanes and floods to fires, electrical outages, and terrorist actions. These events could destroy the high-availability storage systems and servers at a given location. Therefore, managers must develop recoverability strategies as well as high-availability strategies.

Disasters happen, and the results can be disastrous for the companies involved. Various studies conducted in the late 1980s suggest that two out of every five companies that experience a major disaster never resume operations. Of those that do resume operations, one out of three goes out of business within two years. Two years after a disaster, 60 percent of all affected enterprises are defunct. A large part of the reason, observers suggest, is that the organization's data assets were sufficiently damaged, only partially recovered, or recovered too slowly, any of which resulted in a variety of losses.

RECOVERABILITY OPTIONS

"To ensure the protection and recoverability of data, managers have a variety of options to choose from," explains Jon Benson, StorageTek director of tape engineering, Client Server Libraries. In most cases, a recoverability strategy will include a combination of the following options.

- Tape backup
- Offsite tape storage
- Remote vaulting
- Remote data mirroring
- Remote mirrored server/storage clusters
- Hot sites

Each option must be considered in terms of its cost and performance, and evaluated as to its appropriateness for a given application and data. Again, critical applications and data will merit the investment in options that deliver faster recoverability. "In general, there is a direct relationship between recovery speed and cost," Benson points out. Of course, there are numerous variations within each option, and new advances in tape backup and mirroring will continually produce new options. The basic options are the following:

- **Tape backup**—the process of backing up data periodically, usually nightly, to removable tapes. In the event of a disaster, the tapes can be retrieved and the data can be restored to functioning storage devices. Tape backup, a core information systems discipline, typically is used in conjunction with offsite tape storage and hot sites. While tape backup is inexpensive, it does not ensure rapid recovery. Tapes must be retrieved and loaded. Functioning storage devices and servers must be located.
- **Offsite tape storage**—a secure, remote facility in which to store backup tapes. This ensures that the data assets can survive a local disaster. Offsite storage is inexpensive, but again, it alone does not lend itself to rapid recovery.
- **Remote vaulting**—the process of backing up software over the network to a remote location. It achieves a result similar to offsite tape storage, but it eliminates the need to physically make tapes and transport them to the backup location.
- **Remote data mirroring**—exact copies of online data are sent electronically across the network to a distant site where they are stored. Remote mirroring may be nearly instantaneous (synchronous mirroring), ensuring an accurate, up-to-the-moment copy of the data, or it may be done in a batch mode (asynchronous mirroring), which results in data that may be several hours out of date. Remote mirroring can be costly, but it ensures rapid data recovery from a disaster. Ultimately, some data may require instantaneous remote mirroring while other data may require less expensive batch mirroring.
- **Remote mirrored server/storage cluster**—operates similarly to remote data mirroring except that the entire system, application and data, is mirrored. This provides fast and comprehensive recovery, but is costly. Again, not all applications and data justify this level of recoverability.
- **Hot sites**—standby remote locations containing servers and storage devices and often user workstations ready at a moment's notice. In the event of a disaster, recovery teams arrive at the hot site with data tapes and are ready to replicate the information systems operation in the new location. Hot sites provide comprehensive information systems recovery, but are costly.

Some level of tape backup and offsite storage are implemented almost universally. Managers can add other recovery options based on the data and application recoverability needs of the business.

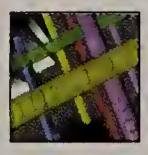
DATA RECOVERABILITY BUSINESS CASE

Recoverability can be costly, but the current generation of data recoverability solutions offers a wide range of cost-effective options. In addition, "managers can prioritize data based on its business value to reduce recoverability costs by assigning less costly options to less critical data," advises Benson.

When considering cost, managers must recognize that the cost of a data storage system is usually much less than the cost associated with the loss of data. Direct costs associated with the loss of data include the loss of transactions during the problem period and lost employee productivity. In addition, there are losses related to degraded service quality and lost opportunities. These latter costs can be greater over the long term than the direct costs.

Dataquest has calculated the cost of a system outage resulting in the inability to access and process data to range from $14,500 per hour of outage to a whopping $6.5 million per hour, depending on the scope of the outage and the size and nature of the organization. Even at the low end of the scale, with per hour costs measured in tens of thousands of dollars, an outage of a few hours or a few days can be devastating.

Given the stakes involved, managers must ensure that effective data protection and recovery strategies are in place. Fortunately, the falling cost of storage and communications bandwidth and advances in storage management technology combine to make the task easier.



Until recently, LAN-centric approaches have dominated thinking about storage management in the open systems environment.

Advanced Storage Management Solutions

Until recently, LAN-centric approaches have dominated thinking about storage management in the open systems environment. In the LAN-centric approach, the storage sits behind each server, which has its own branded, proprietary storage architecture. Any communication between storage devices occurs through servers and over the LAN.

The LAN-centric approach, however, has a number of drawbacks in

terms of scalability, accessibility, recoverability, and manageability. The problems arise from the difficulty in sharing storage and balancing storage workloads across all storage devices. For all practical purposes, each server and its accompanying storage are separate islands. Extra storage capacity at one server, for instance, cannot readily be used to relieve a storage crunch at another server. Similarly, one server's storage cannot easily be used to backup another server.

What is required, notes Robinson, is a data-centric approach to storage management. In such an approach, data would be stored on storage devices equally accessible to a wide variety of servers and applications. The storage devices could communicate among themselves to coordinate their activities for purposes of high availability, scalability, recoverability, and manageability.

The emergence of Fibre Channel, a high-speed communications link, opens the possibility of effective data-centric storage management. It allows organizations to connect servers and storage across distances as great as 10 kilometers at speeds of 100MB per second or faster. Conventional SCSI (small computer system interface) connections are limited to a few yards. "By combining Fibre Channel and switching technology, managers have a very efficient communications capability that can be used to create effective storage area networks (SAN)," Robinson explains.

The SAN, a storage approach initially developed for use with minicomputers and supercomputers in the form of VAX clusters and ESCON links, consists of a pool of storage now connected by fast Fibre Channel communications links. This pool of storage resides on its own subnetwork and can be shared by multiple servers.

The SAN allows for a data-centric approach to storage. Servers are attached to storage only to perform specific tasks, and storage communication chores are removed from the corporate network, according to Datalink. Ultimately, any server can access any storage device and storage can be balanced among the storage devices. Similarly, storage devices can be used to back up each other.

Datalink expects SANs to be deployed in three phases. Phase 1 consists of replacing conventional, slow SCSI storage connections with Fibre Channel, dramatically increasing the distance and speed of the communication. Phase 2 will introduce SAN-specific capabilities not available with SCSI. Phase 3 begins the full era of data-centric storage, with server and LAN functions independent of storage.

The SAN will deliver benefits in a number of key areas:

BACKUP AND RECOVERY STRATEGY

Markel Corp.

BACKGROUND Managers at the rapidly growing, $500 million specialty insurance company knew they needed to backup a steadily increasing volume of data. The existing server-by-server tape backup process, however, was hopelessly inadequate. The company was already wrestling with the backing up of 400GB of data stored on RAID disk arrays attached to 55 servers, running Windows NT and Novell primarily. By the end of 2000, Markel managers anticipate handling 1TB of data.

PROBLEM The company backed up data to tape using distributed backup solutions at each server. The time and effort required to back up multiple storage arrays attached to multiple servers, however, had become significant. At the same time, mistakes were increasingly frequent because of the complexity of juggling so many tapes in a complicated rotation of daily incremental backups and weekly complete backups.

SOLUTION A detailed assessment, analysis, and evaluation led by Steve Gaidos, manager of data center operations, resulted in a decision to implement centralized enterprise storage backup. After evaluating a number of options and vendors, Markel, working with Datalink, opted for the StorageTek Enterprise Tape backup system consisting of tape robotic hardware and VERITAS backup management software. This was the most cost-effective solution, especially in light of the anticipated growth of its data, reports Eric Neidermeyer, director of technology services.

RESULTS All servers are backed up nightly through the automated StorageTek robotic unit, which also creates a second copy for offsite storage. In addition, the organization experiences faster backups, which will allow it to backup even more data within its overnight backup window as the company grows. Finally, personnel that had been required to operate the manual tape backup process are now available for other tasks. Neidermeyer calculates the payback on the enterprise tape backup system at 2-1/3 years, and managers are assured that the organization's data is safely backed up each night with a copy sent offsite.

● **Scalability**—through the use of switches and hubs, organizations will be able to add storage capacity to the SAN, independent of servers.

● **Reliability**—fault isolation achieved through the use of switching will enable truly hot pluggable storage subsystems, allowing organizations to add and replace storage without affecting operations.

● **Accessibility**—users will be able to access stored data without regard for which particular server controls access to the data.

● **High availability**—RAID and cluster technology work significantly better when supported by the performance and features of SAN, such as dynamic re-allocation of resources through zoning, fault isolation, and hot attachments.

● **Recoverability**—the 10-kilometer distance of Fibre Channel allows efficient remote mirroring at a sufficient distance to ensure protection from all but the most widespread disasters.

With the emergence of SANs, managers increasingly have the means to implement data-centric storage strategies that effectively leverage and protect the data asset. Although all the pieces necessary for full-featured SANs won't be in place for several years, Datalink reports that enough pieces are available today for managers to begin exploring the SAN option and gradually migrate to it.

Integrated Storage Management Strategy

An integrated storage management strategy allows an organization to put its data assets at the center of the storage effort. This provides both tactical and strategic benefits, according to Datalink.

From a tactical standpoint, a data-centric storage strategy separates storage from other system resources, allowing organizations, for example, to add servers based on application needs instead of storage and storage management needs. It also "frees the corporate LAN to perform its communication role without being swamped by storage-related functions such as backup," Robinson explains.

From a strategic standpoint, "SAN-based integrated storage management enables managers to better align their business strategies with their data and applications, and effectively organize system and storage resources to support those strategies," Meland adds. It provides an infrastructure that will support the data asset into the future by accommodating growth and ensuring availability and recoverability. It also provides a logically centralized, if not necessarily physically centralized, management infrastructure that allows for efficient and cost-effective administration of data storage. Finally, it will enable organizations to take advantage of the ongoing storage price-performance improvements so that they can store and protect more data for less money.

An Integral Part of the Business Strategy

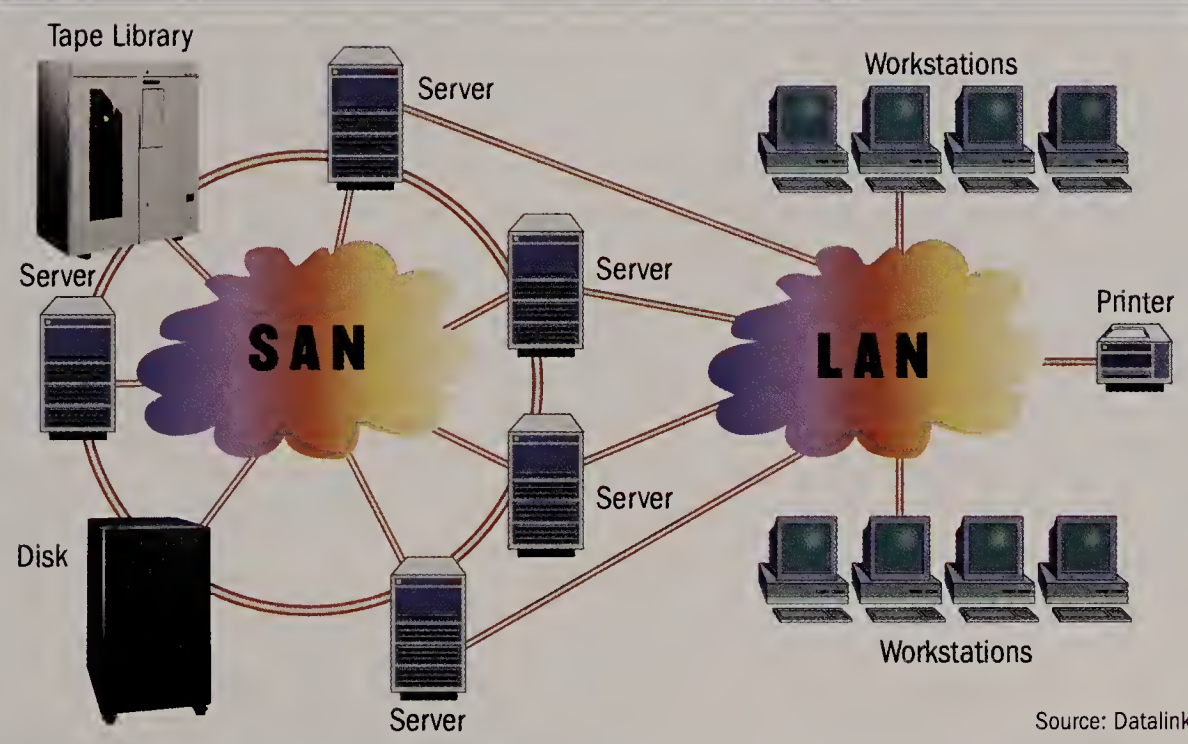
Two critical factors are coming together to make a compelling case for storage management as an integral part of the business strategy:

● Storage costs consume 50 percent or more of the IT systems budget

● Data represents a valuable corporate asset

"With so much money at stake and because of the crucial role data plays in the very success of the organization itself, managers cannot remove themselves from the storage management decision," Meland asserts. Rather, managers face a bottom-line imperative to align their organizations' business goals with storage management strategies–fully leveraging and protecting their corporate data.

Storage Area Networks: A Data-Centric Approach



Storage area networks remove storage functions from the LAN enabling greater benefits in scalability, reliability, accessability, high availability and recoverability.

EDITOR'S NOTE: *Contributors to this paper include the professional staff of Datalink, a leading information management solutions provider, and StorageTek, a worldwide storage systems manufacturer.*

THIS SUPPLEMENT WAS WRITTEN BY ALAN RADDING, A FREELANCE BUSINESS AND TECHNOLOGY WRITER BASED IN NEWTON, MA.

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Trendlines

What, Me Worry?

You're in your office, crunching the schedule, and suddenly it hits you: All the programmers in India could rain down on your company like manna from heaven and you still wouldn't finish Y2K remediation in time.

Your choices:

a) submit your resignation

b) check if your life insurance has a suicide exclusion

c) fire up your browser and visit the following sites for the lighter side of Y2K

Answer: C

Dave Barry's Getting the Bugs Out
www.herald.com/archive/barry/archive/july27.htm
This is the legendary column suggesting that Skip the handyman could probably straighten out Y2K in a couple of hours.

Stanley Bing's I'm OK. You're OK. R U Y2K?
www.pathfinder.com/fortune/1998/980907/out.html
Fortune's anonymous executive makes a list of everything he has to upgrade, including his wife, children and cocker spaniel.

Lincoln Spector's 2,000 Maniacs
www.currents.net/magazine/national/1412/gigg1412.html
In one of his Gigglebytes columns, computer humorist Lincoln Spector interviews somebody named William B. Barnum, head of the Digital Doomsayers consulting group. Spector: "What will you be recommending at your conference?" Barnum: "That people attend our follow-up conference in the fall."

Westergaard Year 2000's on the Lighter Side
www.y2ktimebomb.com/Special/OTLS/index.htm
The Y2K Doghouse yaps at people who just don't get it. Y2K Jokes includes haiku, humor and attempts at humor (the last two are not the same thing). Y2K Songs includes parodies like "It's a Stalled World" (to the tune of "It's a Small World") and "Two Digits for a Date" (to the tune of the theme from Gilligan's Island).

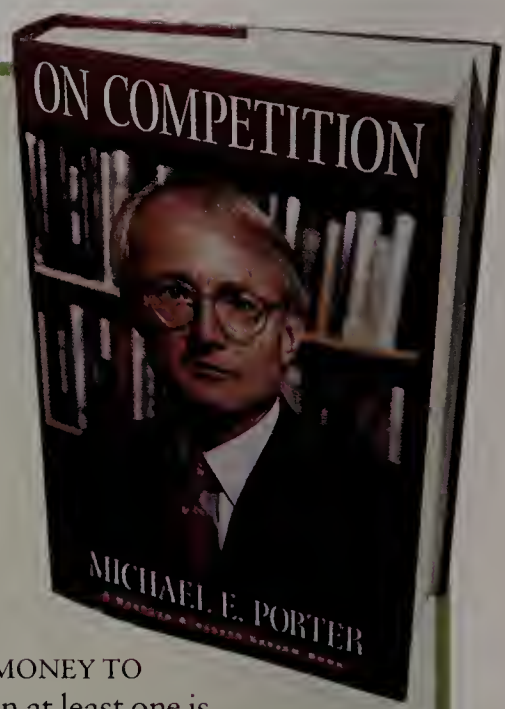
Duh 2000
www.duh-2000.com
The stupidest things anybody (including Bill Gates) has ever said about the year 2000 problem.

Leonard Sloan's Y2K Fun Page
www.leonardsloan.com/about/y2k
The really funny part about this is that Leonard Sloan & Associates Inc. is actually a uniform apparel firm in Dallas. So how did this end up on its Web site? Does Leonard know?

–Howard Baldwin

Off the Shelf

Oldies but Goodies



On Competition

By Michael E. Porter

The Harvard Business School Press, 1998, $35.95

THIRTY-SIX DOLLARS IS A LOT OF MONEY TO pay for 13 essays, especially when at least one is 20 years old, but if any business writer can demand that price—and get it—it's Michael E. Porter. Porter is the C. Roland Christensen Professor of Business Administration at the Harvard Business School, the recipient of a passel of impressive academic honors and the author of 15 books.

Porter's fans will be delighted with this latest collection. In spite of the age of some of the essays ("How Information Gives You Competitive Advantage" was published in the Harvard Business Review 14 years ago), the depth of analysis remains compelling and the scope of Porter's ideas always impresses.

The first of this book's three parts, "Competition and Strategy: Core Concepts," warns readers to avoid confusing strategy with operational effectiveness and to start thinking of it as finding new ways to deliver value.

Part two, "The Competitiveness of Locations," talks about the many and varied factors that make a particular country or a particular region more competitive than another. Labor, policy, demand and competition are examined. Some of the advice in the 8-year-old first essay, "The Competitive Advantage of Nations," does seem out of step with the times. How, for example, would today's Internet titans, companies such as Netscape and Sun and America Online, respond to Porter's advice to "sharply limit direct cooperation among industry rivals"?

The third and final section of *On Competition*, titled "Competitive Solutions to Societal Problems," gives us four newer essays that present a kinder, gentler Porter.

"Overall," writes Porter, "the American system for capital allocation is not serving the American economy well." Porter would like to see a more equitable distribution of wealth and an empowerment of inner cities. He suggests that we expand the ownership of companies, nominating to the board customers, suppliers, employees and community representatives, for example, in an effort to align the goals of corporations with those of society, which generally has greater interest in long-term benefits than do primarily profit-minded enterprises. It is surprising advice from someone who has made large amounts of money telling big business how it can make even larger amounts of money. But it's nice to see it said by someone to whom business leaders listen. *–Art Jahnke*

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The Soft Touch

Retaining critical employees is a hard problem many CIOs address with hard cash. But what do you do if you lack financial resources?

BY MATT VILLANO

ON A GRAY NOVEMBER DAY IN 1997, Ted DellaVecchia, senior vice president and CIO of Capital Blue Cross in Harrisburg, Pa., rallied his troops to talk about teamwork. DellaVecchia had been hired less than two months earlier, commissioned to turn around a struggling IT organization that was losing almost one-quarter of its employees annually. For years, the company's IT department had existed as two separate IS units, and employees weren't happy. The best way to understand why, DellaVecchia thought, was simply to ask them.

So he invited his 410 employees to cite examples of how the company had failed to make them feel like part of a team. Rick Duker, a Blue Cross IT employee since 1985, stood up and pulled out his business card. Duker wondered aloud why his card called him an IS staffer but did not identify him as a member of Blue Cross IT. DellaVecchia asked Duker to bring his card to the podium for a closer look. Reluctantly, Duker agreed. He gave the card to DellaVecchia, who read it aloud again and then tore it to bits. That card, DellaVecchia said, was a thing of the past.

"This notion of two separate [IS] entities—that was exactly the kind of thing I wanted to change," DellaVecchia says, reflecting on the incident. "I told [Duker] he could get the card he wanted. I told them all they'd get new cards. These people are IT professionals, and I told them they deserved to be treated like just that—professionals. They had been wanting to hear that for a while."

Believe it or not, DellaVecchia found, such inspirational demonstrations can make or break an IT organization. With the high-tech economy booming and the number of available IT jobs at an all-time high, the challenge facing CIOs such as DellaVecchia is not just how to get good employees but how to hold on to them. Staff retention, once thought to be determined by salary and quantifiable rewards, has become a complicated mix of nonmonetary benefits and other intangibles. (For a look at how companies are using hard cash to retain employees, see "Hot Skills and Cold Cash," Page 36.)

According to a March 1998 survey by The Gallup Organization Inc. and Carlson Marketing Group Inc., almost 70 percent of the 2,000 IT employees polled said nonmonetary benefits provide the best motivation for sticking

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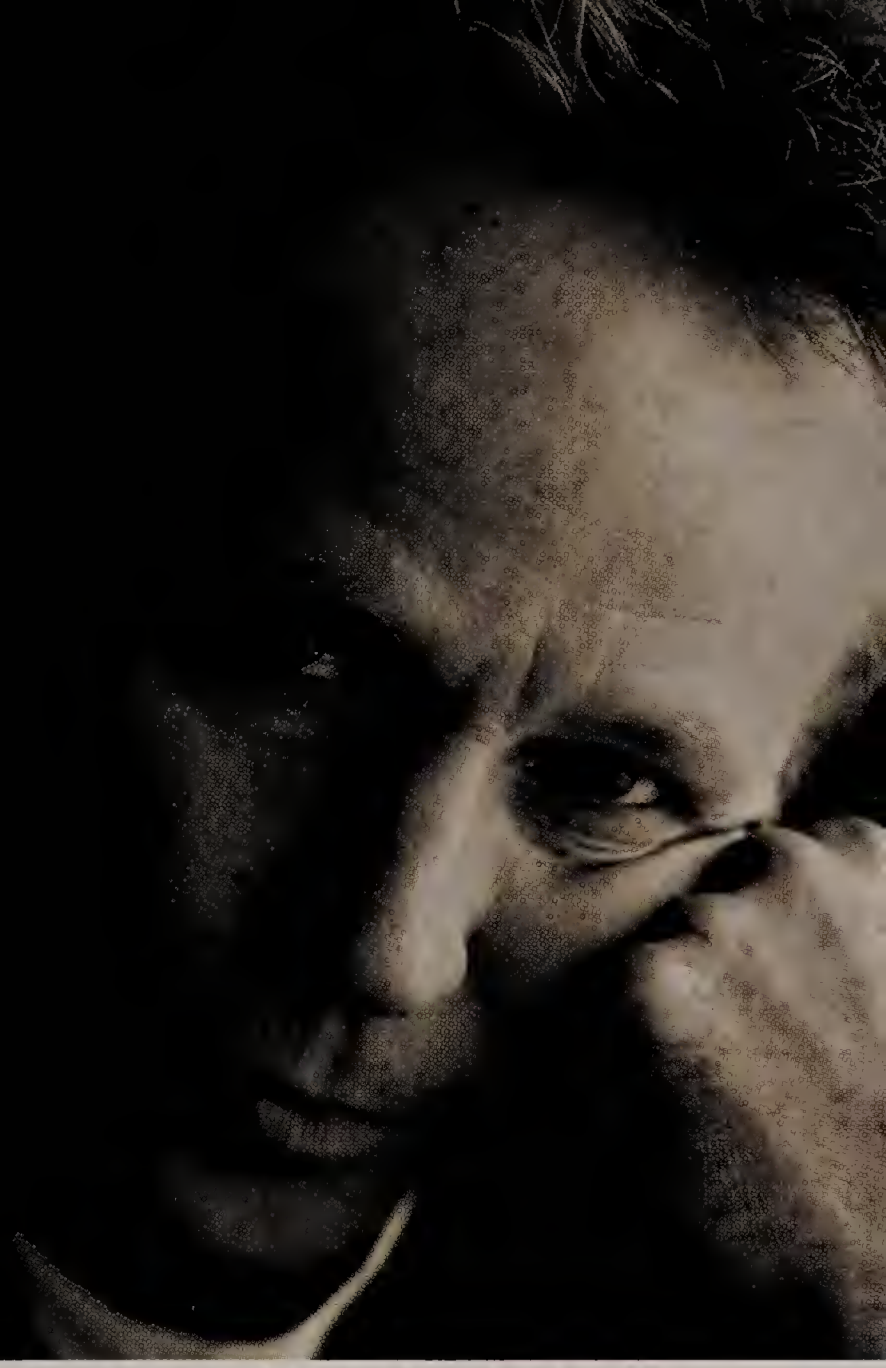

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around. The study also revealed that employees favor recognition from managers and supervisors by a margin of almost 2 to 1 over recognition such as large cash bonuses or salary raises tied to productivity.

"Pay is a great motivator, but it's increasingly losing influence," says David Foote, managing partner at Cromwell Foote Partners LLC, a consulting firm in Stamford, Conn. "You have to pay fairly, but you also have to give people work that's meaningful, work that engages them. The things you learned in Psych 101 have never been more important."

For DellaVecchia, the soft approach is a necessity. Since Capital Blue Cross is a nonprofit corporation, DellaVecchia can't throw money at his staff retention problem. Instead, he has turned things around with a calculated plan that stresses recognition, environmental stability, independence, opportunity for growth and teamwork. Today, 18 months after DellaVecchia was hired, the attrition rate in Capital's IT department has dwindled to 9 percent—well below the IT industry average of about 14 percent. For the first time in recent history, the number of qualified applicants exceeds the number of jobs available in Capital's IT department.

And for those people already on the inside, spirits are high, productivity is up and everyone—including Duker—has new business cards. "Sometimes," says Duker, "money isn't everything."

Work Hard, Play Hard

After that fateful November meeting, DellaVecchia's first formal act as CIO was to create a sense of unity within Capital's IT organization. In the name of progressivism, DellaVecchia began to refer to the department's two IS units—Capital Blue Cross Information Systems and the Shared Services Center, an operations partnership between Capital Blue Cross and Blue Cross of Northeastern Pennsylvania—as the Capital Blue Cross "IT team."

Next DellaVecchia reorganized Capital's IT management structure. Prior to his arrival, the division had seven levels of IT managers—so many that today DellaVecchia claims even he can't list them all. By eliminating more than 40 percent of the managerial positions and combining the rest, DellaVecchia reduced the number of managerial levels to three.

"At first, changing this system was a little like fixing a flat tire on a moving vehicle, but the initial changes served to tell my people, 'Hey, it's a new beginning, folks,'" DellaVecchia says. "I wanted everyone to know I was committed to moving toward a oneness of purpose and being."

Immediately after DellaVecchia announced the structural changes, he made tactical changes to the division. He established a leadership team composed of his top nine managers and arranged to meet with them every morning to discuss the status of certain assignments as well as larger issues. The intent, DellaVecchia says, was to create a greater sense of oneness among his top brass. For the rest of his people, DellaVecchia instituted quarterly, departmentwide meetings at which all his employees were welcome. Soon Capital's IT atmosphere changed dramatically.

"The things you learned in Psych 101 have never been more important."

–David Foote

One of the people to notice that change was Marie Roof, director of application systems and a member of Capital's IT leadership team. Roof says that although some of Capital's IT employees had a hard time adapting to DellaVecchia's style, in the end few seemed to mind.

"We were amazed at how much warmer the environment had become," says Roof, a 12-year Capital employee. "The fact that [the CIO] actually wanted to talk to everyone with such regularity was a totally new concept to us. We felt like we had become part of something special."

Once he established this new structure, DellaVecchia concentrated on opening lines of communication throughout the division. He started a Capital Blue Cross intranet, which he uses as an interactive newsletter. Then he initiated an "ambassador program" through which he randomly invites employees to meet with him, often over lunch. All employees have the option to refuse his invitation, but most relish the opportunity to talk face to face with the boss. By talking with him privately, DellaVecchia adds, Capital's IT employees feel like they are ambassadors for their colleagues. "I have programmers knocking on my door to talk to me," DellaVecchia says proudly. "Sometimes they're so eager to chat that it's hard for me to get any work done."

Distractions aside, DellaVecchia boasts, his open-door policy is a good one. The friendly environment gives DellaVecchia daily opportunities to indoctrinate employees in his life philosophy—work hard, play hard. In a phrase, the sentiment epitomizes what has become of the division as a whole.

"You can't help but get involved in [DellaVecchia's] philosophy because when you're around him his intensity and passion for making things work is infectious," says Joe DeLutis, a five-year Capital IT veteran who, like Duker, holds the position of technical staff member. "As I say to my wife every night, I'm having the time of my life right now."

The Intangibles

Hand in hand with DellaVecchia's "work hard, play hard" campaign came an increased effort to recognize employees on every level for good performance. He gave his managers full autonomy in negotiating contracts on certain projects—a freedom unprecedented in the history of Capital's IT division. He urged those same managers to thank hard-working staffers publicly at the quarterly department meetings and to single out dedicated workers in intranet postings. If one particular group of employees does something exceptional, DellaVecchia writes a congratulatory memo and distributes it throughout the department.

This recognition strategy also includes more tangible rewards. DellaVecchia has taken advantage of the company's "extraordinary performance award" program, giving small cash bonuses to employees who consistently excel, and his managers honor positive attitudes by giving employees a Night at the Movies—

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a folder of gift certificates for two free tickets, popcorn and soft drinks at a local movie theater. Both are further efforts to remind his people that heroism in the workplace is priceless.

Perhaps the largest components of DellaVecchia's strategy are his commitments to giving his employees interesting projects and providing them with constant opportunities to expand their knowledge of the IT field. DellaVecchia says he tries to give all his people assignments on the cutting edge and encourages them to suggest new technologies whenever they see fit. Regularly, DellaVecchia books speakers and invites his entire department to listen. Often these speakers are leaders in the IT industry. Sometimes DellaVecchia brings in CIOs from competing health maintenance organizations so that employees can get an idea of what's happening elsewhere in health care. DellaVecchia also follows corporate policy in offering his employees a number of onsite training courses as well as full tuition reimbursement for any IT-related classes at qualified universities. "Every person has different receptors," DellaVecchia says, "so I tried to cover every base in carrying out a broad thank-you policy."

In Duker's case, DellaVecchia's investment in new business cards was just the beginning. Duker says that before DellaVecchia arrived, he was becoming frustrated with what he considers Capital's "conservative" approach toward using innovative technology. After the November meeting, DellaVecchia sat down with Duker, heard him out, then asked him to research a switch to newer relational databases and personal productivity software. DellaVecchia accepted most of Duker's recommendations, then publicly thanked him for his input.

"We're trying to build well-rounded professionals, for our sake and for theirs," DellaVecchia says about assigning Duker to assess the company's technological needs. "If you invest in [your employees], trust them and give them the opportunities to learn the business, they will invest more of themselves in you."

"If you invest in your employees, trust them and give them the opportunities to learn the business, they will invest more of themselves in you."
–Ted DellaVecchia

The intangible, nonmonetary benefits DellaVecchia instituted in the Capital Blue Cross department go on.

- Staffers can telecommute or use flextime if they can demonstrate that they need such special considerations.
- Department workstations are fitted with new furniture and state-of-the-art computer equipment—a direct contrast to the old, run-down workspaces of a few years ago.
- In some instances when employees work late, DellaVecchia has his managers buy them dinner.
- There's an annual IT outing, and just this year there's talk of a Capital IT talent show.

"I don't think any of this stuff is new, but if you're sincere—which [DellaVecchia] definitely is—these things really work wonders," says Roof. "Work should be more than just a job. It should be just as much a part of you as anything else. All these things put together make a huge difference in how I feel about coming in each day."

Psychology for the Ages

Roof's realizations are nothing new. Almost 60 years ago, psychologist Abraham Maslow developed his "hierarchy of needs," which explained what motivates people. According to Maslow, people can achieve their needs for self-actualization and psychological happiness only after they fulfill their basic survival and security needs, that is, money, food and shelter. Foote, the consultant, says corporations like Capital Blue Cross that cannot offer employees six-figure salaries are able to stimulate employee creativity and motivation through methods that don't involve a lot of money.

DellaVecchia adds that once people reach a balance of money and noncash benefits, retention is no longer an issue—they're in it for the long haul. That's the kind of environment DellaVecchia has attempted to create at Capital and is precisely the reason why DeLutis, one of his technical staff members, says he plans to stay with Capital well into the next millennium. "I've got money in the bank, more responsibility than I've ever had, and I'm still able to coach my son's junior high school football team," DeLutis says. "That's the kind of life everyone dreams about. Stability and peace of mind. You can't put a price tag on that." CIO

Matt Villano is a freelance writer based in New York City. He can be reached at mjv@whalehead.com.

Retention Tips

SO YOU WANT TO HOLD ON TO YOUR BEST PEOPLE, but you don't know how. Here's a quick reference guide to the finer points of a retention strategy as devised by David Foote, managing partner of Cromwell Foote Partners LLC, a consulting firm in Stamford, Conn.

Know what's out there. Nonmonetary benefits don't mean a thing if your salaries aren't competitive. Collect market data at least twice per year.

Make it personal. Recognition is good; personal praise is better. And be certain that no hard work goes without comment.

Be creative. Sure, cash bonuses convey a sense of appreciation, but so does a free round of golf at an award-winning course.

Invest in them. Training programs should never be a budget line item. Where possible, spend a minimum of 5 percent to 7 percent of your IT budget on education. Your investment will pay off immediately. *–M. Villano*

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Hot Skills and Cold Cash

When money talks, nobody walks. Here's how to make your dollars speak volumes.

BY DEBBY YOUNG

When Barbra Cooper stepped in as CIO of MicroAge in 1994, IT talent was hemorrhaging from the Tempe, Ariz., technology and integration services company at an alarming rate. Within weeks of her arrival, one of the key programmers handling the company's mission-critical systems (inventory control and distribution) left to become an independent consultant. Cooper had no choice but to hire him back. At triple his former salary.

Two years later, in December 1996, now group vice president and CIO of Toyota Motor Sales USA Inc. in Torrance, Calif., Cooper immediately instituted an aggressive retention program in hopes of avoiding a similar scenario.

First Toyota analyzed the market to determine the market value of all the programmers working on the company's Y2K project. The people who were being paid below market level immediately received salary increases.

Then Toyota allocated a "milestone bonus" pool within the Y2K budget to be disbursed at the discretion of the project director. Another bonus pool was set aside as a "completion bonus" to be awarded to project participants at the end of the Y2K project.

Reader ROI

CAN MONEY STOP I.T. WORKERS FROM going from shop to shop? In this article you'll learn

- Different ways to leverage bonuses
- How to target the employees who should receive them
- What types of bonuses work best in which situations

PHOTO BY JEFFREY CAMP

Holding the fickle: Tom Giordano, Burger King's CIO, instituted a formal retention strategy that brought turnover down from 30 percent to roughly 10 percent.

One stayed, one didn't: **Bob Roth (left), a development manager, stuck with PeopleSoft because he felt appreciated and rewarded for his work. Josh Bregman, a GTE Laboratories programmer, left his previous job for the opportunity to work with new technologies.**

PHOTO LEFT BY STU ROSNER; PHOTO RIGHT BY FURNALD / GRAY

Toyota also instituted a short-term "hot skills," or "star pay," bonus for Cobol and RPG programmers—between $100 and $500 a month above their base salaries. They'd be eligible for this bonus for the duration of the Y2K project but not beyond.

Finally, Cooper instituted a policy giving managers the flexibility to award bonuses to key employees who were being recruited by other companies.

Given Toyota's historically low turnover rate of 2 percent, why did Cooper feel compelled to rush in and mandate such an extensive policy? As she saw it, being a large Cobol shop, Toyota's Y2K effort would fall squarely on the shoulders of long-tenured employees whose salaries hadn't been leveled against the market. In other words, they were grossly underpaid.

Since Cooper instituted her multipronged retention bonus program in March 1997, Toyota's Y2K project has not lost a single person.

THE PRICE OF DOING BUSINESS

Cooper isn't alone. With the well-reported labor shortages in the industry (see *CIO* Section 1, Dec. 15, 1997/Jan. 1, 1998, or *www.cio.com/archive/010198_inprint cio.html*), CIOs across the country are groping for strategies to keep competitors and consulting houses from luring their best IT talent. According to Linda Pittenger, CEO and president of Somerset, N.J.-based People3 Inc. (a company affiliated with Stamford, Conn.-based GartnerGroup Inc. that specializes in human resources consulting to IT organizations), GartnerGroup has determined that the demand for skilled IT professionals currently outstrips supply by 30 percent. She says it's not uncommon for $55,000-a-year programmers to command a six-figure salary the minute they have trained in SAP and implemented just one SAP module. And if your IT organization isn't willing to meet that price, well, lots of other companies are. According to a January 1999 report published by GartnerGroup, about 40 percent of North American companies offer bonuses to their IT professionals in response to the current IT turnover rate, now hovering between 8 percent and 17 percent a year. And by 2001 GartnerGroup projects 70 percent will have instituted IT bonus programs as a regular part of their compensation practices. (See "Showing Them the Money, Page 46.)

"The problem with bonuses is that they're no longer perceived as value-added [because they're so ubiquitous]," asserts Joyce Gioia, president of Greensboro, N.C.-based management consulting company The Herman Group Inc. "But if you don't have [them] and everybody else does, you're at a competitive disadvantage."

Gioia calls the decision of whether or not to pay bonuses a "no-brainer." Depending on how critical the employee's job, industry experts place the cost of replacing him or her anywhere between one and three times the person's annual salary, at a minimum. And when you figure in the cost of recruiting and training a replacement, not to mention the

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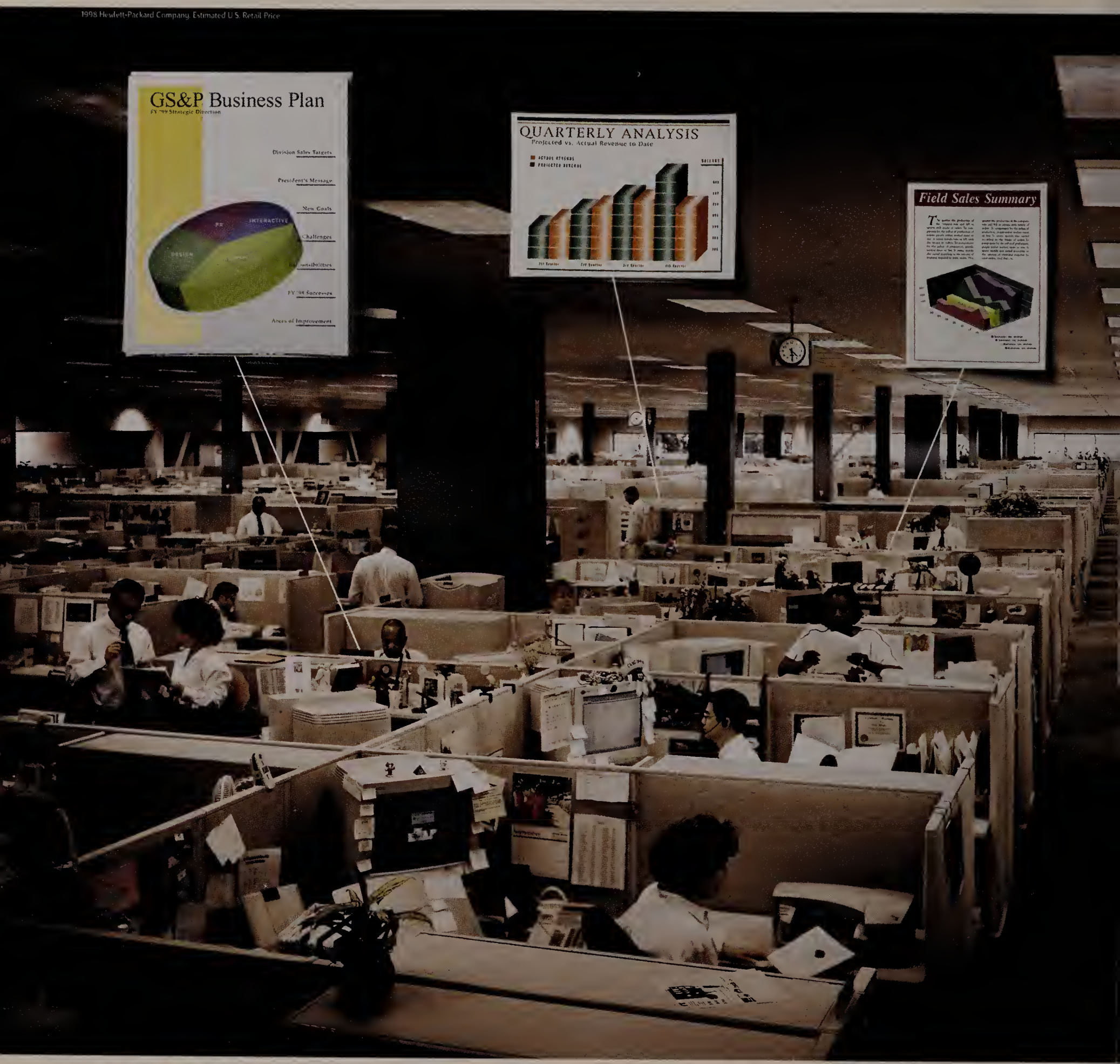

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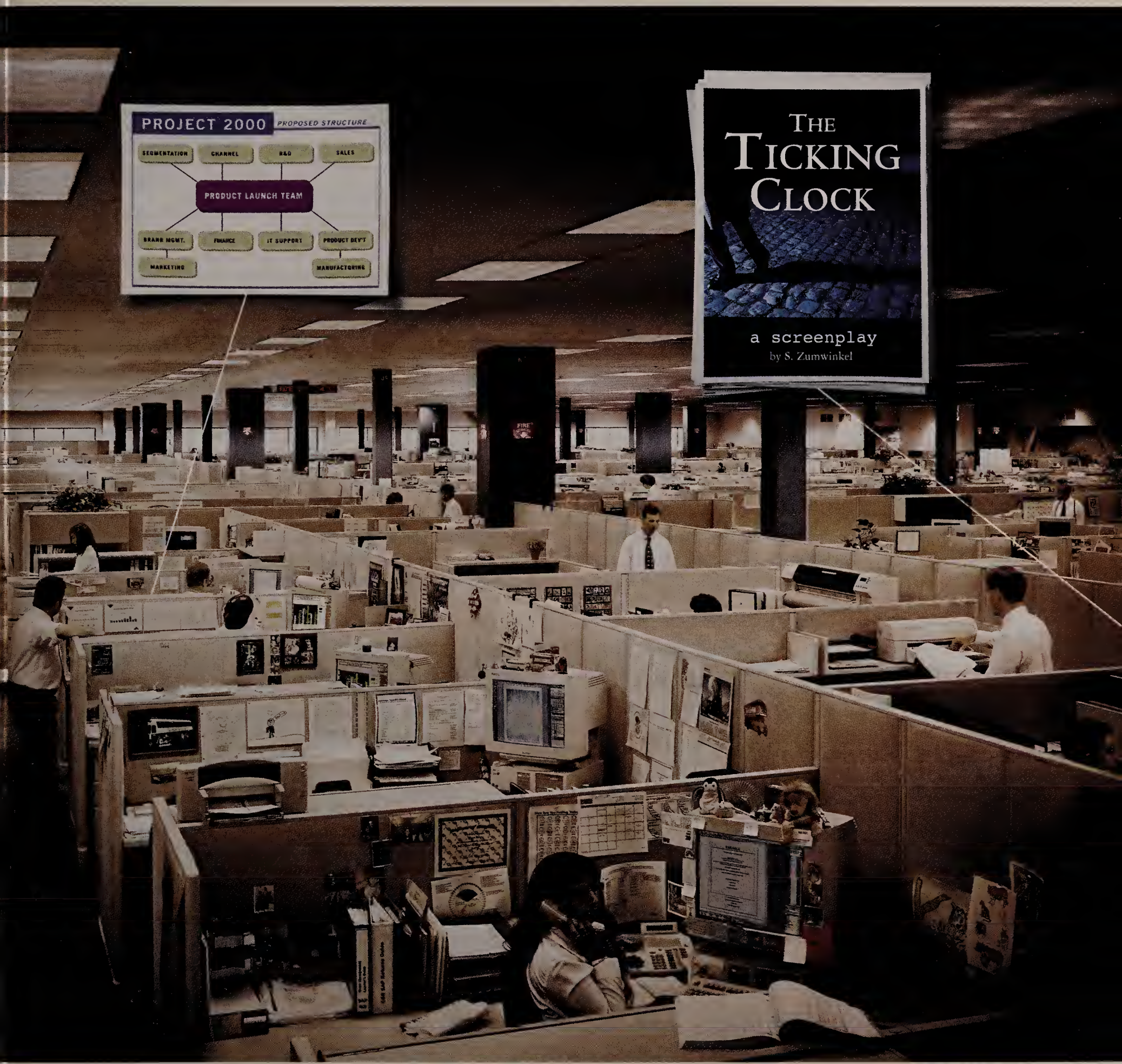

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> **"I don't even talk to headhunters anymore."**
>
> **-Bob Roth**

financial impact of delaying an important project for lack of expertise, it often seems smarter to shell out the extra bucks for the talent you already have on hand.

Of course, money isn't everything. Few employees will remain loyal if you're simply correcting outdated compensation practices or if you fail to provide other, nonmonetary incentives such as continuing education credits, onsite day care, health club memberships, flexible vacation policies and so on. (See "The Soft Touch," Page 28.) Nevertheless, bonuses can be an important element in a comprehensive retention strategy.

ONE STAYS, THE OTHER DOESN'T

When Josh Bregman was a programmer at IBM Corp.'s Integrated Systems Solution Corp. in Southbury, Conn., he was offered a hefty increase at another company. To convince him to stay, his manager offered him a 30 percent raise and reassigned him from his Lotus Notes project to a new team involved in what to Bregman was more interesting—electronic commerce technology.

"It wasn't so much the money," says Bregman. Though the money was "a genuinely nice gesture," he continues, "the thing that really mattered to me is that they found a way to get me back on the career track that had been promised to me by going to work there."

The bonus bought IBM another eight months of Bregman's time. But eight months was all it bought. Only two years out of school, he was lured away by GTE Laboratories Inc. in Waltham, Mass., with a further increase in pay, the attraction of living near a big city (Waltham is just outside Boston) and, most important to him, the promise of more exciting Web-based projects.

On the other hand, Bob Roth, a development manager for Pleasanton, Calif.-based enterprise resource software company PeopleSoft Inc., decided that lucrative stock-option bonuses and quarterly merit bonuses, up to 10 percent of his salary, were a convincing argument for staying put.

"I don't even talk to headhunters anymore," says Roth, who adds that, in his opinion, it makes sense to pay to retain your best people. "To me," he says, "the thing that's important is that [the bonus] is *not* part of your salary. It's based on your performance." And Roth suggests that the bonus a company offers a top performer should be a significant one—at least $2,000 a quarter—"to make a difference."

Formerly a teacher, one of the reasons Roth left the classroom was that his compensation wasn't tied to either talent or effort. "I worked my butt off," he says. "I thought I was the best teacher these kids ever saw. And I got the same pay and no bonuses, just like the bonehead in the room next to me."

Two men, two different bonus strategies, two different outcomes. Bregman is in his early 20s, single and carefree. Roth is in his late 40s with a wife, two children and roots in the community. The lesson? Simple. You have to understand what motivates your employee, what is important to him, before you can decide on a bonus strategy.

The realist: According to Toyota Motor Sales USA CIO Barbra Cooper, IT professionals are "going where the cool technology is, where the pay is best and where they can get continued skill-building."

PHOTO BY RON KRISEL

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FRANK TALK FROM BURGER KING

Executives at Miami-based Burger King Corp. faced the same issues as Cooper did at Toyota. Burger King programmers and analysts trained in SAP were being heavily recruited, with companies offering substantial increases, sometimes double whatever they were making. The employees' decision to jump ship was understandable, but it put the company's SAP project in dire straits. Tom Giordano, senior vice president of MIS and CIO of Burger King, recalls that the company had to employ consultants to staff a number of projects to keep the company's SAP Financials implementation on schedule. "We augmented the implementation with consulting services and continued to deliver the key milestones on time," he says, but "it had a significant impact on the cost."

Giordano believes part of what put him in this unfortunate situation was Burger King's ad hoc bonus program. When he joined the company in July 1998 it had no formal bonus program, although occasionally a project-specific milestone bonus would be paid. It wasn't clear to staffers what type, magnitude or length of project would qualify for a bonus, nor what the size of the bonus would be. Because IT staff members felt they couldn't count on the bonus, Burger King's retention strategy was ineffective: Turnover shot up to around 35 percent.

Giordano has since instituted a formal Hot Skills Bonus Program to compete with market scale. Some skills, like SAP, Oracle, SQL Server and point-of-sale system technology, get quarterly bonuses ranging from 10 percent to 30 percent of the employee's base salary. Since instituting this program in the summer of 1998, Giordano has watched turnover decline steeply to 10 percent to 12 percent.

Giordano adds a caveat: To avoid misunderstandings, you have to be upfront with employees as to who gets paid a premium and why. Before launching its Hot Skills program, Burger King spent a lot of time with focus groups at all levels of the IT organization. Management was open about the process. "It's a very market-driven mechanism," explains Giordano. Burger King's IT staff now understands that given present market anomalies, the company has to pay a premium to retain certain people with high-demand, limited-supply skills critical to its operation.

GOLDEN HANDCUFFS

The premium paid to retain people with the skills you need is climbing every day. According to Bruce Clark, chairman and CEO of Danbury, Conn.-based IT retention consultancy Stabiliteam Inc., IT salaries for workers with hot skills like GTE's Bregman are climbing by over 30 percent a year. "You have to have bonuses to make sure that people are paid close to market," Clark warns. "And you've got to make rapid adjustments to make sure that their compensation stays there."

In working to stabilize client companies' project teams, Stabiliteam first adjusts workers' salaries to market rate and then keeps them current through regular indexing. Premium skills and completion bonuses ensure that there's continuity to the end of a project. "We focus the [incentive] program on trying to keep the [consultants and in-house staff] together," says Clark. Everyone on the project—excluding upper management—gets the same deal (the same percentage of salary, not the same dollar amount). If you stay to the end of the project, you get the bonus.

Stabiliteam's clients typically experience turnover rates ranging from 50 percent to 75 percent. Clark says that after his company goes in, turnover often drops to zero. In the longer term, those rates typically will rise again, to between 10 percent and 15 percent, but not, he asserts, for financial reasons.

Clark's ultimate goal is to bind employees to Stabiliteam by making sure that they're not going to jump ship in order to find better-paying jobs.

GartnerGroup calls this practice "golden handcuffs"—trying to lock employees into their jobs with big bucks. It can be proactive, as in the case of Stabiliteam, where the continual reassessment of current market rates for specific skills is corporate policy. Or it can be reactive, as was the case with Bregman, where the threat of his departure resulted in a cash offer. In either case, keeping the handcuffs on can be expensive. If money is the only tool a company employs to keep an employee happy, then there will always be someone with more money (or someone who is more desperate) than you. What money can't do is alleviate the anxiety felt by talented people who fear they're missing out on a rising market, as did Bregman. Roth, on the other hand, has remained loyal to PeopleSoft, not only because of the equity he holds but because he genuinely likes working for the company and feels it acknowledges his contributions.

ADDING VALUE TO DOLLARS

People want to feel valued," says Herman Group's Gioia. "They want to feel appreciated." In the market, money is—pardon the expression—the gold standard for making people feel appreciated. But according to Gioia it's not just a matter of how much, it's how the money is delivered that counts.

For example, CCBN.com, a 1997 startup that provides leading-edge investor communication services over the Internet, took a different tack in spending to retain employees. Rob Adler, president of the Boston-based, 60-person firm (its IT department numbers 15), explains that "from the day we opened our doors, we've paid below-market salary." To compensate, CCBN.com rewards performance aggressively with a liberal bonus policy. Employees can earn up to an additional 20 percent of their base salaries at six-month intervals, depending on individual performance and on whether the company hits its business-plan targets. Some would call this a milestone bonus, others a retention bonus and still others might call it long-term incentive pay. Adler also motivates key staff by offering equity in the company. Employees own 20 percent of CCBN.com through a vesting program. You get some stock options upon joining (a long-term strategy), and additional grants are awarded semiannually

Turnover is often a sign of other underlying problems.

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Showing Them the Money

SOME CIOS TAKE A NEGATIVE VIEW OF THE TERM *RETENtion bonus*; they like to award *performance* bonuses or *skills* bonuses. The bottom line is that you're spending money to keep your projects and your organization up and running. Some bonus strategies are designed for the long term, some for the short. Use a short-term strategy to address a long-term problem and you're headed for trouble. Here are some of the strengths and weaknesses of the various bonus types.

Retention bonus. Used to entice employees and contractors to stay through a long-term project, these bonuses typically range from 50 percent to 100 percent of salary, paid out incrementally, with a bigger back-end payoff. It won't buy long-term loyalty because you're asking (and paying) for a finite commitment.

Stay-put bonus. Paid quarterly and designed to bring salaries up to market level. There can be a backlash once that value diminishes and the bonus is discontinued.

Spot bonus. Selectively reward key contributors, pivotal performers or steadfast workers. Rewarding performance, these bonuses can foster a culture of productivity. They also keep star performers content because employees know the company recognizes and values their contributions.

Project milestone pay. Paid out when an individual or team hits a particular release or milestone within the project plan. Typically used for large-scale implementations like SAP or Y2K. Considered very effective because employees know from the start what they have to do to earn them.

Premium skills pay. Given to employees with hot skills—Cisco network administrators, SAP programmers and so on. Ranging from 5 percent to 30 percent of salary, these bonuses keep you in a constant bidding war, measuring compensation against an ever-changing market. A short-term strategy.

Long-term incentive pay. Awarded on anniversaries of employment, these bonuses will work only if combined with short-term payout. Otherwise, few employees will stick around for that pot of gold at the end of the calendar.

Star pay. Rewarding the top three to five producers in the IT organization, CIOs pay the money upfront, virtually whatever the star wants, to prevent defections to competitors. These will keep your stars on board until someone comes along and offers them more. Then, as the Terminator says, it's *hasta la vista*, baby.

–D. Young

according to performance.

"We've been fortunate that people continue to be willing to take less to be here for what they perceive as the future financial rewards," says Adler. But he also credits the extremely low turnover rate (he's lost two people since February 1997: one was fired; one left after 30 days) to an environment that allows IT people to stretch their talents in the latest Internet communication technology. IR Eye, the company's delivery system, enables publicly traded companies to present investor relations data to shareholders on their Web sites.

Toyota's Cooper agrees that monetary rewards cannot stand alone. As she sees it, IT professionals with hot skills are "going where the cool technology is, where the pay is best and where they think they can get continued skill-building." If you can't create an environment that combines all those attractions, she believes you'll find it very difficult to keep and even recruit people, no matter how much money you throw at them.

FOSTERING LONG-TERM LOYALTY

Offering bonuses is often a knee-jerk reaction to turnover. But outdated compensation aside, turnover is often a sign of other underlying problems: ineffective managers, limited opportunities for professional growth, a hostile corporate culture. If you want to attract and retain good people, don't forget the fundamentals. In addition to fair compensation, you have to create an environment that nurtures career development. If that means recruiting more skillful, supportive managers, do it. If it means using contractors to support legacy systems in order to give your in-house staff a crack at the sexier new technology, do it. If it means setting aside an escalating annuity for training in a hot technology, do it. Toyota offers an aggressive education program to its Y2K project team, and Stabiliteam provides accelerated education credits to Y2K project participants that will help bring them up-to-speed on the latest IT skills once their long-term commitment to the current project has ended.

As many CIOs are discovering, the way to your programmer's heart isn't always through his wallet. Be creative. You'll never stop turnover. But there's a lot you can do to keep it manageable. CIO

Debby Young is the owner of d'scribe, a freelance writing business based in Framingham, Mass. She can be reached via e-mail at dscribe@erols.com.

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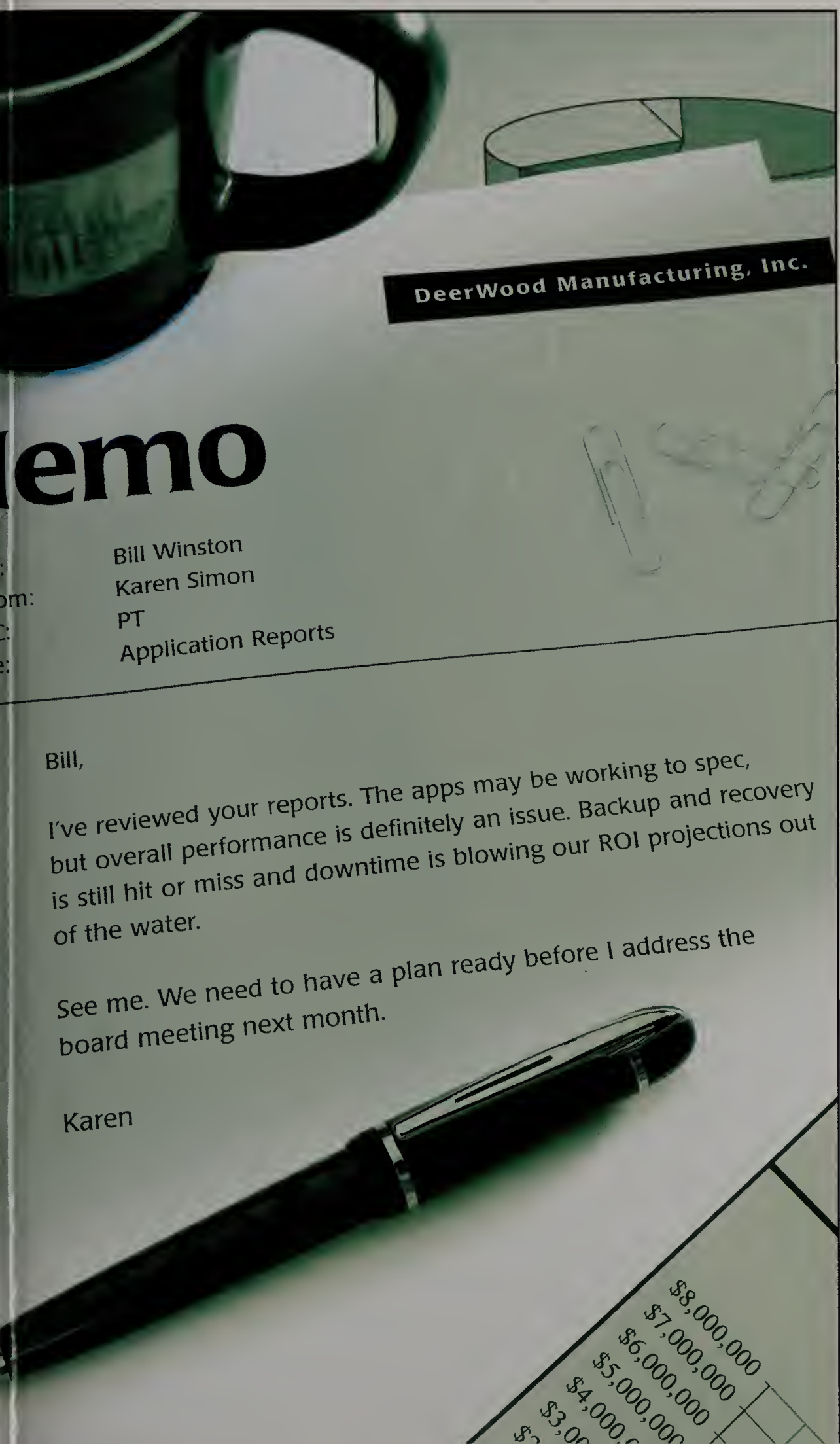

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Bob Higdon, Turner Industries manager of research and development, designed the first program for estimating and then tracking Turner's maintenance "turnarounds" for giant companies like Exxon.

A Lead-Pipe Cinch

With smart software, Turner Industries can estimate down to the last weld. And that's the sweet spot where good IT and good business intersect.

BY MATT VILLANO

THE YEAR WAS 1994, AND TURNER Industries Ltd. was about to embark on a routine maintenance project for its largest client. The job, which involved pipe fabrication and plant maintenance for part of an Exxon Corp. oil refinery, had been scheduled and budgeted nearly two years in advance. Turner, a $600 million organization that specializes in large-scale construction and repairs at petrochemical plants, had estimated that the project would take 12 weeks and millions of dollars to complete. A little more than 10 weeks later, however, Turner's job was done. That time saved—almost 10 days—translated into more than $8 million in unexpected earnings for Exxon, according to Turner. The result? One very happy customer.

Indeed, in an arena where competition is tough, margins are slim and missing a deadline means losing money on a multimillion-dollar job, Turner has developed such a rock-ribbed reputation that some enormous jobs aren't even put up for bid. They're just handed to Turner. The Baton Rouge, La.-based company has set new standards in efficiency, accuracy, profitability and customer satisfaction. The key? A homemade software application that integrates two proprietary programs with two industry-standard stovepipe applications.

Called Interplan, Turner's application combines

Reader ROI

BY READING THIS STORY, YOU'LL LEARN

- How IT can enhance customer service so much that clients no longer care what your competitors bid
- How combining proprietary and off-the-shelf software can pay big dividends in profitability and competitive advantage
- How technology can improve workers' morale and productivity

PHOTOGRAPHY BY DANNY TURNER

proprietary estimating and project control programs with J.D. Edwards & Co.'s World ERP software and Primavera Systems Inc.'s P3 scheduling package. Turner uses its estimating program, called WinTake, to bid a job, then uses the J.D. Edwards software to manage costs and the Primavera package to sequence tasks. Once a job has begun, Turner uses its own project control program, called WinPCS, to manage and gauge progress every day. With such careful monitoring, Turner avoids cost overruns that would otherwise come out of the company's pocket.

Experts describe the system as a fully integrated process that is broader and more efficient than most of the other systems currently used in the construction and petrochemical industries. "Turner's system is about as deep as they come," says Jim Tudrick, director of the vertical support group in service industries for Denver-based J.D. Edwards. "Almost every construction and petrochemical company uses our software, but Turner is one that has added to our software and leveraged it to get ahead."

In five short years, returns on Interplan have impressed clients and developers alike. Using Interplan, Turner can accurately estimate a project's time and costs right down to the last nail. It can also show customers benchmarks of how much time and money it should take to fit a certain piece of pipe.

Internally, Turner's business and IT executives are enjoying record profits—at the end of 1998 the company had doubled in size and sales volume since Interplan. Its profit margins run significantly higher than industry averages, and satisfied customers and record-setting growth have brought Turner national recognition as an industry leader. Last year Turner was named one of *Forbes*' "500 Top Private Companies." The company ranks third on *Engineering News-Record*'s 1997 list of top refinery and petrochemical plant contractors. And in January it was awarded its fourth "Excellence in Construction Award" in five years from Associated Builders and Contractors Inc. Interplan has received some awards too. After the Exxon job in 1994, WinPCS was awarded the U.S. Senate Productivity and Quality Award.

Such attention could cause some IT organizations to get a swelled head and lose focus. Not Turner's. G. Patrick Thompson, the company's vice president and CIO, says his organization remains focused on using technology to meet three goals that apply to IT in every company: providing good customer service, establishing a serious competitive advantage and earning a solid return on the company's initial investment.

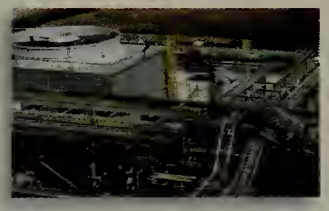
A Complicated Business

Turner's system was designed with simplicity in mind, but the company itself specializes in some of the most complicated businesses imaginable. Composed of 14 diversified subsidiaries, Turner provides all services necessary to complete industrial projects. Perhaps the most lucrative of Turner's tasks are "turnarounds"—scheduled maintenance projects for large petrochemical facilities, like the one at Exxon.

Each turnaround involves thousands of diverse tasks such as welding segments of pipe and cleaning and replacing huge storage tanks. In the 1980s, when software companies started manufacturing programs to automate job control capabilities, such programs weren't up to the job of estimating and tracking large turnarounds, says Bob Higdon, then Turner's director of planning (he's now manager of research and development). Instead of purchasing a stovepipe application, Higdon developed the Pipe Budget Report, or PBR. (At first PBR covered only piping jobs, but it was later expanded to cover every kind of work Turner did.) Originally written in Cobol for an IBM Corp. mainframe, the system was rewritten in Clipper around 1990 to run on DOS-based PCs, which made it more convenient to use. Meanwhile, Turner's estimating process was separate and largely a manual procedure carried out with hash marks on printed spreadsheets. Some estimates took weeks.

Over the next few years, Higdon continued to improve the program, but when Thompson came aboard as CIO in June 1993, he changed everything. Thompson's top priority was to get Turner's operating system on par with the new industry standard, and that meant switching to Windows. Because PBR then ran on DOS, the program needed to be rewritten to work in a Windows environment. Thompson says he also saw this as an opportunity to upgrade the program to make it quicker, easier to use and generally more functional. "The whole thing was a strategic decision to get the company to a more current state of technology," he says. "Even though things worked just fine [before], transforming IT into a state-of-the-art environment just made sense."

Thompson invested in an IBM AS/400 system, then set out to transform Turner's IT infrastructure. Thompson organized a team of 14 end users, project managers,



Turner Industries at a Glance

Location: Baton Rouge, La.

Employees: 1,000 permanent staff; 10,000 to 12,000 contract laborers

Revenues: Approximately $600 million

System hardware: Compaq Computer Corp. servers, desktops, laptops; Toshiba America Inc. handhelds; IBM Corp. AS/400

System software: Microsoft Corp. Windows 95, Visual FoxPro, Office 97; Micromega Systems Inc.'s Foxfire; J.D. Edwards & Co. World software; Primavera Systems Inc.'s P3

Network: Microsoft Windows NT; Novell Inc. NetWare

Telecommunications: Cisco Systems Inc. routers running TCP/IP; dial-up and dedicated links

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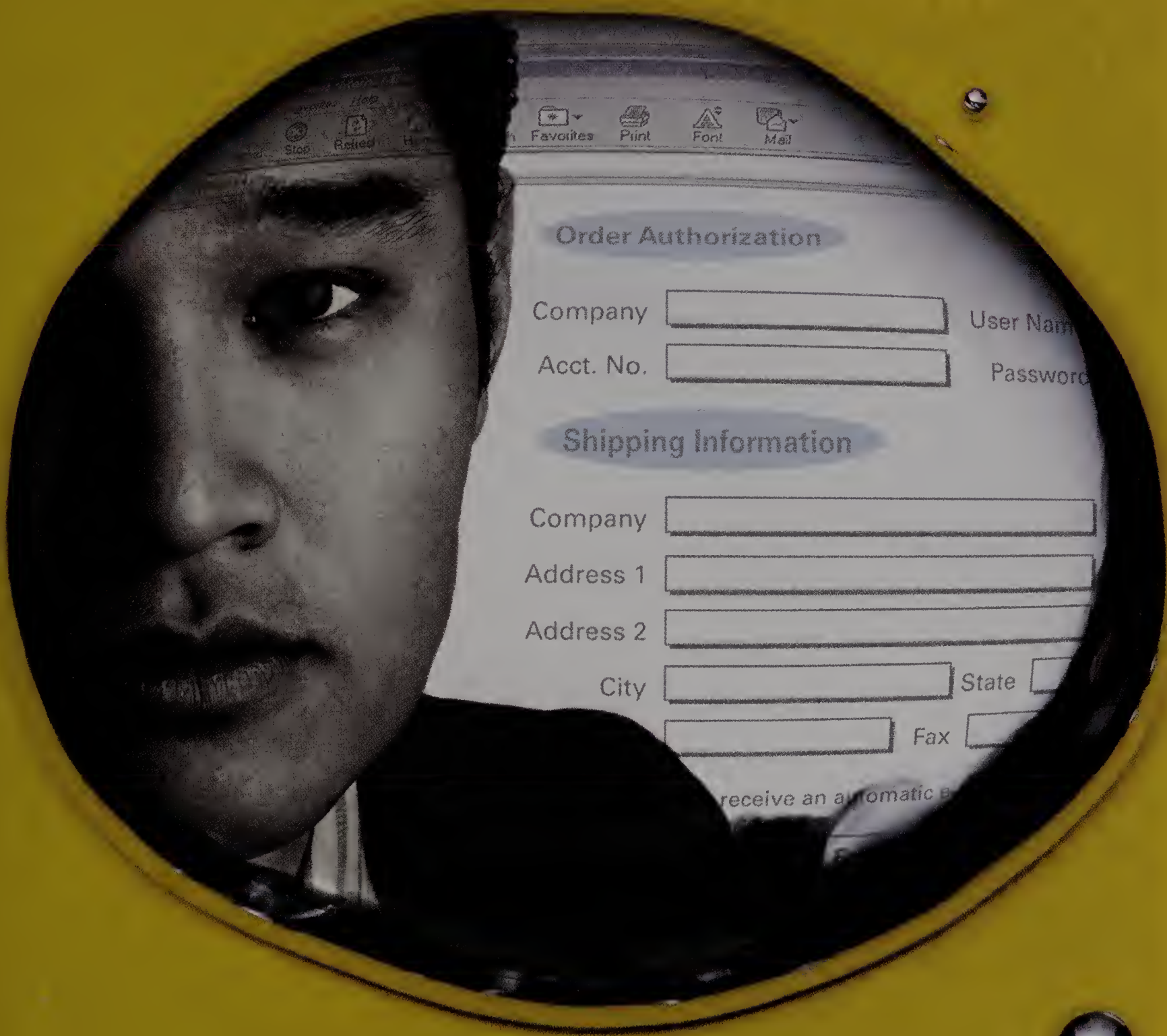

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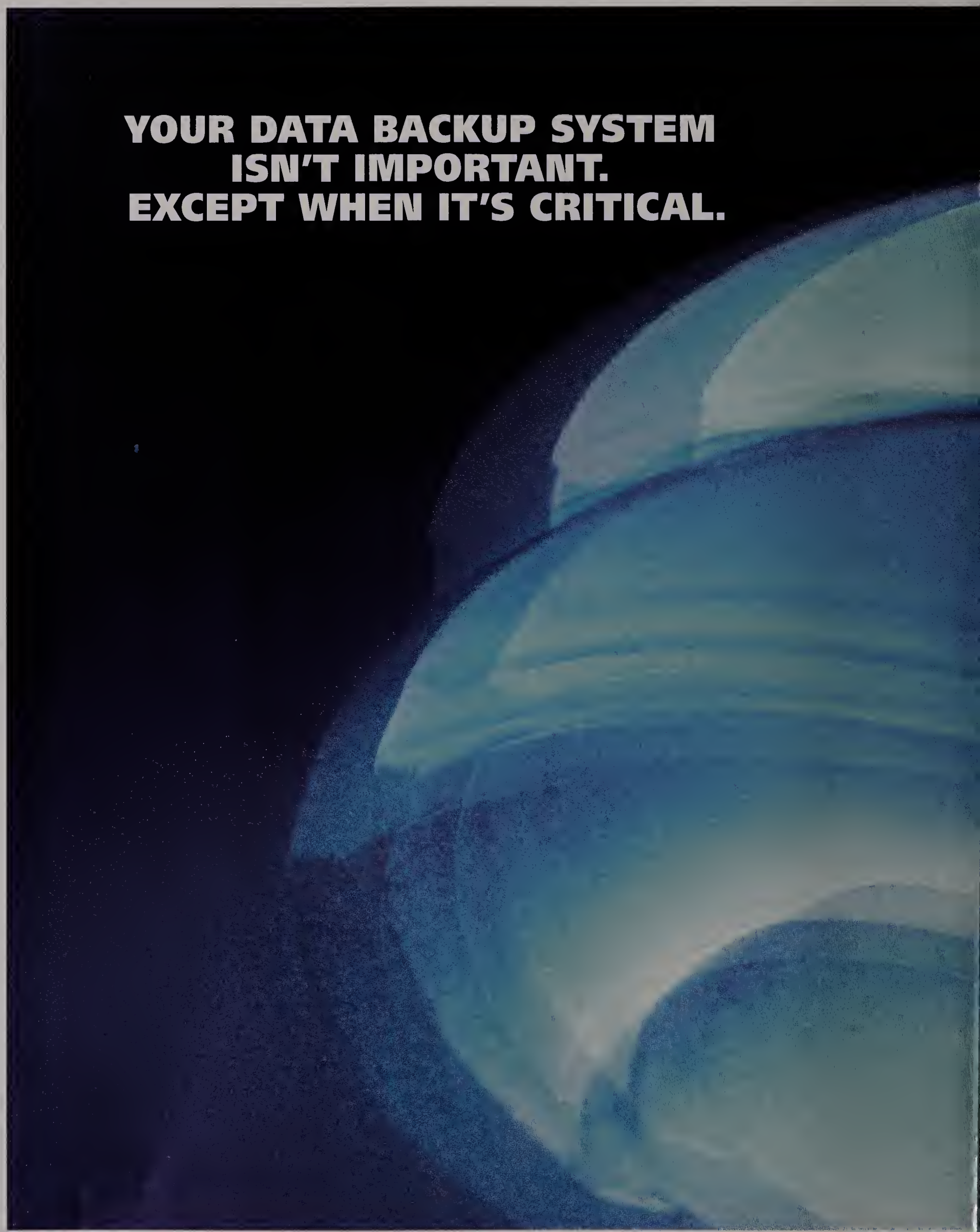
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executives and developers to see how they could best upgrade the PBR into a Windows-based application. The team decided that the crux of the new system would be a completely new version of the PBR—one that included two separate components for estimating and project control. Team members also realized that to build a competitive system, they had to enhance the PBR, not just rewrite it. Because customers would be using the new system with Turner's onsite work crews, team members decided to incorporate programs that were popular across the construction and petrochemical industries—World and P3. Executive Vice President Thomas Turner, who ultimately signed off on a $700,000 investment in the new system, says that in the end, radical change was the only choice.

"If there was [one basic] product on the market that met our needs, I would have rather stayed in the construction business than dabble in software development," says Turner, whose father, Bert S. Turner, founded the company in 1961. "But we took a long, hard look at what was available, and we realized that to get [a tailored solution], we had to improvise."

Anatomy of an Interplan

Programmers worked with Higdon and his coworkers to rewrite the components of PBR into Windows-based applications. Using Microsoft's Visual FoxPro, the team finished WinPCS by summer 1994; they rolled out WinTake's four industry-specific components between March 1997 and January 1999. These proprietary programs, together with the World software and P3, comprise Turner's entire Interplan process.

The process begins with WinTake. Turner's estimators receive blueprints and a list of primary materials for a job, and they enter dimensions and other specifics into the WinTake interface. Estimators can use a digitizer board to obtain information directly from job blueprints. When all requisite information has been entered, the program automatically calculates the tasks that need to be performed, the number of hours the project will take, the materials that need to be purchased and all associated costs. Thompson says the program has made Turner's estimators more than twice as fast, translating into hundreds of thousands of dollars of savings for both clients and Turner itself.

Once a client approves an estimate, WinTake automatically transfers data into Interplan's three other components. Costing data is sent to the ERP software, which interprets data from the job site every day and tracks cost as it relates to budget, eliminating surprises and unplanned expenditures at the end of the project. Scheduling data goes straight to the Primavera program, which is constantly updated so that planning managers can have an accurate idea of when a job will end. Lastly, data regarding labor and the tasks involved in a job are sent to WinPCS.

Once WinPCS receives this information from WinTake, the program generates a "punch list" of every task involved in the job. Sometimes the list can

Great Minds Think Alike

By combining proprietary and off-the-shelf systems, Bechtel Corp. has developed a competitive advantage of its own

TURNER INDUSTRIES LTD. ISN'T THE ONLY COMPANY IN the construction industry to leverage its own software for a competitive advantage and better customer service. Ask Tim Horst, manager of construction resources and technologies at Bechtel Corp.'s Gaithersburg, Md.-based Bechtel Construction Operations Inc. division, and he'll tell you Bechtel has done the exact same thing.

Bechtel, an engineering and construction company based in San Francisco, uses a suite of software applications that Horst calls ProjectWorks. The system incorporates proprietary programs with a Primavera P3 scheduling package, much like Turner's Interplan. Though the companies aren't direct competitors, both of their IT systems simplify specifics. The main difference between the two is in functionality. While Turner's homespun software helps estimate and track a job, Bechtel's proprietary programs help facilitate the exchange of information between different software programs, improving the efficiency of project execution.

"We've taken major applications and plugged them into this information exchange to move data from one layer to another," Horst says. "It enables one software program to communicate with another and enables us to eliminate a number of layers between our workers and the design product."

Bechtel makes extensive use of three-dimensional computer-aided design applications in much of its work, and uses ProjectWorks to transfer extra design information and import construction status into the three-dimensional project models. ProjectWorks has permitted Bechtel to significantly reduce cycle times, increase work collaboration and reduce costs on the work it performs, Horst says.

Like Turner, the company has healthy profit margins and a number of regular clients who keep business coming in. Horst says repeat customers are especially happy with the way Bechtel delivers information and adds that they'll pay extra just to know what they can expect. This, he adds, is perhaps the area in which the two companies have the most in common.

"[Both companies use] technology to simplify larger construction projects, give back to the consumer and, ultimately, get ahead," he says. "This has been the drive for 25 years or more. Whether [Turner is] doing it or we're doing it, it's good to know it's being done."

–M. Villano

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contain more than 40,000 tasks—such as tightening a bolt or welding a small section of pipe. The list is usually generated and maintained by staff on the job site and is customized to best inform and meet the needs of the foremen of the job's work crews. At the end of every day, foremen are instructed to estimate how much of each task they've finished. Foremen hand the completed list to onsite planners and cost engineers, who enter the information into WinPCS, then hook up a T1 connection and transmit the information to planning managers at company headquarters. Field personnel also use the data to schedule and manage work from the job site.

At periodic intervals throughout the job—daily for turnarounds, weekly for larger construction jobs—job site staff use the information to print productivity curves for each crew. The curves are used to compare the performance of individual work crews with a progress average calculated by WinPCS. If one particular crew shows below-average performance for any given week, project managers approach the foreman of that crew to find out what went wrong. John Richmond, planning manager for Harmony Corp., a construction outfit based in Baton Rouge that is Turner's largest subsidiary, says the productivity data is used to monitor the overall progress of a job. "This data isn't a Big Brother kind of thing but really a way for us to see how much of each job falls into the original scope of work," says Richmond. "Sometimes we'll find out a crew never got necessary material from our client. Other times, we'll see that a crew is working way ahead of schedule."

Richmond is quick to point out, too, that all field data is subjective—foremen dictate the progress they report. While there are no incentives for foremen to overestimate productivity, he says, the presence of onsite auditors discourages underreporting. Turner's experience is that, largely, its people are honest. Richmond remembers a turnaround during which project managers publicly posted productivity curves to inspire healthy competition among work crews. Foremen with extraordinary productivity offered help to those crews that came in below average. Laborers posted congratulatory notes for their colleagues in other crews, and Turner managed to finish the job ahead of schedule.

"If there was one basic product on the market that met our needs, I would have rather stayed in the construction business than dabble in software development."

–THOMAS TURNER

The Payoffs

The ultimate measures of success for this productivity curve system—as well as Interplan as a whole—are in customer satisfaction, return on investment and dramatic growth of the company's bottom line. Thompson says that perhaps the most rewarding effects of the new process have come in the area of customer service. Onsite, Turner's goal is no longer to finish jobs on time but to try to finish them ahead of schedule. Back at headquarters, estimators are learning from their successes and mistakes, constantly changing the way they bid jobs. For customers, this one-two punch means that Turner's Interplan system becomes more efficient with every job. Rarely does Turner finish a job behind schedule, and testimonials about turnarounds like the 1994 job at Exxon are becoming more commonplace.

Some companies call on Turner for what they consider an "honest estimate." In these cases, prospective clients send architectural blueprints to Turner for a forecast of how much money they should budget for their projects. Turner sometimes does these estimates for free as a way to create goodwill with potential customers, Thompson says. In perhaps the strongest showing of customer confidence, Turner also has renewal contracts with a number of Fortune 500 companies in the petrochemical industry, allowing it to skip the bidding pro-

G. Patrick Thompson, Turner vice president and CIO, moved Turner's tracking and estimating program from a DOS to a Windows-based environment, and then enhanced it.

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cess on some projects, he says.

Exxon became one of Turner's repeat clients in 1994, after the now-famous turnaround at the company's largest refinery in Baton Rouge. Lynn Leek, a senior engineer at Exxon Chemical Co., headquartered in Houston, says that when Turner bid the job, he and his colleagues—who had long used Primavera—were amazed at how Interplan could handle detail and saw it could work in ways Primavera couldn't. Although Exxon occasionally still uses other contractors for some jobs, Leek says, "we've calculated that [going with Turner] translates into an advantage [for us]."

The more frequently Turner satisfies its customers, the more frequently customers will come back. The cycle has resulted in a remarkable return on the initial $700,000 investment in the Interplan process. Since 1994, the company's revenues have climbed from $361 million to approximately $600 million. While the IT budget has never exceeded more than 1 percent of total revenues, Thompson estimates that as a result of increases in revenues, project profits and productivity, Interplan—along with Turner's growing reputation—has accounted for some $200 million of that sum.

Thomas Turner cites another figure as evidence of Interplan's success. Margins at Turner Industries have always averaged slightly higher than those across the construction and petrochemical industries—around 2 percent or 3 percent above industry average—and Turner says that because the system is so comprehensive and accurate in estimating and planning jobs, his company experiences an additional 3 percent increase in profit margin on projects for which it uses Interplan.

Those percentage points add up. "Our competitors are so screwed up with trying to get their systems to run that they don't have time to worry about enhancing their money-making tools," Turner says. "We've had [these] terrific applications up and running for [almost six] years, and they're still worried about getting their bean-counting straight."

"We've calculated that going with Turner translates into an advantage for us."

–LYNN LEEK

J.D. Edwards' Tudrick, the ERP vendor, says that while few of Turner's competitors have systems as comprehensive, most of them have also developed proprietary software to supplement off-the-shelf packages (see "Great Minds Think Alike," Page 56). One engineering construction company—Kansas City, Mo.-based Black & Veatch Corp.—uses an online process control system that, according to Ken Hammond, the company's commercial process architect, offers clients more flexibility than Interplan. Because the system works off the Internet, says Hammond, project managers don't have to "fuss with" a T1 connection to access the database. All they need is a modem and a dial-up account.

Thompson says moving Interplan to the Web is on his list of future goals. In the meantime, Turner has upgraded its AS/400 hardware from a CISC to a RISC platform and plans eventually to move to an industry-standard client/server environment. Like the initial move to Windows, this is a complicated improvement that will take time. In the end, however, Thompson says the switch will further enhance the services Turner has to offer, bettering the system by making it quicker and easier for customers to use onsite. "This market is increasingly demanding, and when our clients say they want information, we have to give it to them in a way that makes sense immediately," Thompson says. "Just because our industry is complex doesn't mean we can't keep it simple." CIO

Thomas Turner, executive vice president: The company's founder's son signed off on a $700,000 investment in a new proprietary system.

Matt Villano is a freelance writer based in New York City. He can be reached at mjv@whalehead.com.

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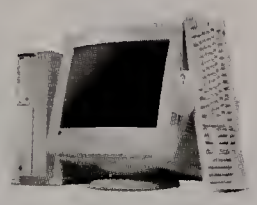

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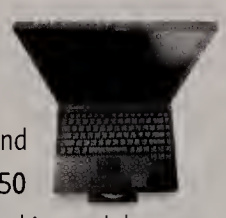

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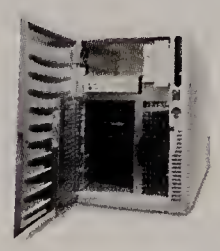

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Free Radicals

Freeware promises to give CIOs control over their computer systems' destiny. Should you join the revolution?

BY DEREK SLATER

EVERYBODY'S HEARD THE BUZZ ON Linux: Open source code makes modification of the "freeware" operating system easy; it runs on an array of platforms, even down to underpowered hardware like leftover 386s; and best of all, it's free. Or at least extremely cheap. Since "cheap IT" historically has been an oxymoron of colossal proportions, low cost makes Linux—along with Apache Web server software, the Sendmail electronic mail package and a host of other freeware products—an attractive proposition.

That's all well and good for the hobbyist running a bulletin board or the IT worker who does side programming jobs in his off-hours at home. CIOs, however, have a different set of concerns: stability, security and, most notably, service and support. These concerns have thus far slowed widespread corporate acceptance of freeware in general and Linux in particular, since an operating system is such a vital piece of the IT puzzle. But some companies are in front of the pack, already running vital business applications on Linux and other freeware programs. At manufacturing giant Schlumberger Ltd., for example, Linux shows up on the occasional workgroup server. At internetworking company Cisco Systems Inc., the entire corporate print architecture runs on freeware. And Web-based directory provider PlanetAll.com Inc. uses Linux and a freeware e-mail program.

IS personnel who have had firsthand experience with freeware at these and other companies say that while open source software is in-

Reader ROI

BY READING THIS STORY, YOU'LL LEARN

- When freeware is the right choice for corporate applications
- How to balance freeware's risks and rewards
- Why security is less of a concern than you'd think
- Ways to get the support you need

ILLUSTRATIONS BY CHRIS PYLE

deed passing the tests of corporate computing, it requires a change of mind-set and new procedures, particularly in the area of service and support.

FREEWARE IS NOT just free from a monetary standpoint. Its source code is readily available, meaning the IS group can modify the basic program as needed—hence the more proper designation "open source software." Such programs are typically developed by a loose confederation of developers working in their spare time. (See "Love That Linux," *CIO* Section 1, Dec. 1, 1998, or *www.cio.com/archive/120198_et.html* for more background.) These programs generally can be downloaded free of charge over the Internet. Freeware has existed for years, and any corporation is likely to have miscellaneous open source programs floating around, particularly in conjunction with a Unix environment. Linux, however, represents a significant step forward for corporate use of freeware since it is a variant of the entire Unix operating system. The corporation is not likely to grind to a halt in the event of a flaw in a Unix development tool, but if Linux fails, entire applications stop. Apache is similarly crucial, particularly for Web-based or heavily Web-dependent businesses.

So reliability, stability and performance are watchwords for corporate IT. One factor critical to the fulfillment of these needs is the availability of compatible applications. More and more heavy-duty commercial applications are coming to market for Linux. For example, almost all the major Unix database vendors, from Oracle Corp. to InterBase Software Corp., have announced DBMS versions for Linux. But it will take some time for these products to work their way into the corporate setting, and even Linux enthusiasts are hesitant to move certain core business systems to freeware. Schlumberger, for example, runs Linux for some file, Web and e-mail servers, but the operating system hasn't yet achieved the "mindshare" at Schlumberger that would get it used for larger applications such as enterprise resource planning (ERP), says David Sims, technical director in the company's SugarLand, Texas, office. "It's too early to be thinking that way; you have to crawl before you walk and run."

Still, Schlumberger is the type of highly decentralized corporation that freeware is so good at infiltrating. A $12 billion diversified manufacturing and services company, Schlumberger operates sites in more than 100 countries, each typically with its own workgroup servers run by local, highly autonomous personnel. How autonomous? "We have operations in both Iran and Iraq, and when Iraq was invaded, the people there didn't even call headquarters, they just dealt with it," says Sims. That independence gives technical people like Sims the opportunity to bring in Linux as they discover it. As Linux proves its mettle for more industrial-strength applications, Schlumberger and other early adopters will have the advantage of having developed in-house expertise.

In regard to reliability, the open nature of the source code may sound a bit frightening to the average CIO. After all, who wants developers writing custom code and recompiling the entire operating system every time performance needs a tweak? However, practitioners say open source is a boon, not a bane, for IS. "For us, it's an advantage," says Brian Robertson, chief technical officer for PlanetAll in Cambridge, Mass. PlanetAll, purchased last year by Amazon.com Inc., provides online contact management and scheduling. For example, a university alumni foundation or other organization can use PlanetAll's Web site to track members for fund-raising purposes and to apprise them of upcoming activities. PlanetAll produces several hundred thousand customized electronic mail messages per day for its registered users, and it selected a freeware program called Qmail running on Linux as its e-mail platform because of the software's efficient handling of high message volumes. The company is also evaluating a switch to Apache for its Web servers. Having the source code means that when PlanetAll wants to add new features to its site, the development team can compile them directly into the Web server instead of writing separate applications—a major performance boost, according to Robertson.

Whatever other attractions freeware may hold, free is still the operative part of the word for many IS organizations. Dan Davidson, a senior information systems engineer for San Diego-based high-tech research and engineering company Science Applications International Corp. (SAIC), provides information management support through a contract with the U.S. Army at Fort Huachuca in southern Arizona. Linux first found its way onto the base as the server for a data collection application that had been running on a $93,000 AIX system from IBM Corp. Looking for a cost-effective alternative to an expensive upgrade, Davidson's group replaced the entire server with a dual Intel Corp. processor system running Linux for just over $10,000. Impressed, another development group on the base built a 100-processor test bed using Linux on cheap PC clones instead of the originally planned Microsoft NT or commercial Unix systems, with an estimated savings of over $3 million. They say money can't buy happiness, but the Linux users at Fort Huachuca seem pretty darn chipper about their decision. "The government folks like the Linux box better because the tools are friendlier than what they

Linux not only passed an Army security test, it beat the commercial operating systems.

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had been using, and it's been easier to maintain than the IBM machine," says Davidson.

Similarly, fiscal considerations helped inspire San Diego-based Cisco's creation of a companywide, Linux-based print system. Cisco Senior Vice President of IS and CIO Pete Solvik's goal was to create a system with no directly attached printers anywhere in the company. Instead, all printers would be attached to the networks and shared by almost all users, with a Web-based front end for easy control so that, for example, a user can direct output from any computer or server to any Cisco printer in the world. Solvik's crew first looked at commercially available print architectures but didn't find one with the necessary flexibility. Building their own solution became appealing when they looked at the potential savings from using inexpensive Intel-based servers running Linux. The stability of the custom solution has proven acceptable, Solvik says. "Like the early implementation of any IT project, it went through growing pains," but the application has been working solidly for about two years now, he says. He also notes that problems have been fixed with alterations to Cisco's custom coding, not to the operating system itself.

ANOTHER POTENTIAL downside to the free nature of open source code lies in the area of security. Source code that is widely available on the Internet can presumably be poked and probed for weaknesses by hackers of malicious intent. In fact, some express concern that the collaborative development process could allow said hacker types to program back doors and access methods into the code. However, users say Linux and Apache are bulletproof. "Everyone was concerned about just downloading software off the Net; the Army engineers were a little leery of what we had done, so they assigned a team of security analysts to test it," says SAIC's Davidson. After his group set up proper security controls on Linux, it not only passed the test, he says, it outrated all the commercial operating systems for security.

External security is one issue, but CIOs might think twice about the old "disgruntled employee" scenario if the operating system itself can be tampered with, recompiled or otherwise butchered. However, Cisco's Solvik says that's a misunderstanding of the whole issue of internal security. According to him, security is better handled by policies and procedures than by hoping to make hacker-proof code. "There are going to be ample opportunities [for insiders to wreak havoc] if you don't have the proper process to implement changes. You manage that through appropriate supervision and processes and being able to respond quickly in the event something happens," he says. In that respect, open source software provides no more significant risk than commercial software or homegrown applications. "It's maybe 5 percent different but not significantly different," Solvik says.

SO THE WORD is that in terms of reliability and security, freeware is at least as viable as the shrink-wrapped stuff. Life with freeware differs most significantly from commercial software, users say, in the area of service and support.

Database vendor Sybase Inc. uses Sendmail to pass messages from its internal Lotus Notes e-mail system to the Internet. Sendmail is very efficient, according to Jim Lin, postmaster for Sybase in Emeryville, Calif., but "our VP has stated we don't want to use unsupported software." The company has been using Sendmail for a long time, but as Sybase has grown, its receptiveness to freeware has decreased. William Peterson, a research manager at Framingham, Mass.-based market researcher International Data Corp. (a CIO Communications Inc. sister company), calls this

Finding It Online

www.fsf.org

Home page of the GNU Project and the Free Software Foundation, advocates of the open source philosophy for many years under the aegis of foundation President Richard Stallman.

www.apache.org

Home page of the not-for-profit Apache Server Project.

www.linux.org

The Linux home page, hosted by the nonprofit Linux Online: a good starting place for links to Linux resources.

www.linuxjournal.com

Home page for Linux Journal, a print-online publication of Specialized Systems Consultants Inc. that features technical articles and user testimonials. Includes a link to related site www.linuxresources.com, with lots of additional links and information on how to download Linux from the Internet.

www.linuxworld.com

Home page for LinuxWorld, an online-only magazine from Web Publishing Inc. (a CIO Communications Inc. sister company). Not just Linux info—also includes articles on other freeware products such as Apache and Sendmail and links to technical resources. Note: Linux World is also the name of a trade show, LinuxWorld Conference & Expo (see www.linuxworldexpo.com).

www.tuxedo.org/~esr/writings/cathedral-bazaar/cathedral-bazaar.html#toc12

Site of "The Cathedral and the Bazaar," a paper written and posted on the Web in 1997 by software designer Eric Raymond that influenced Netscape Communications Corp.'s decision to open up the source code for its Navigator browser.

–D. Slater

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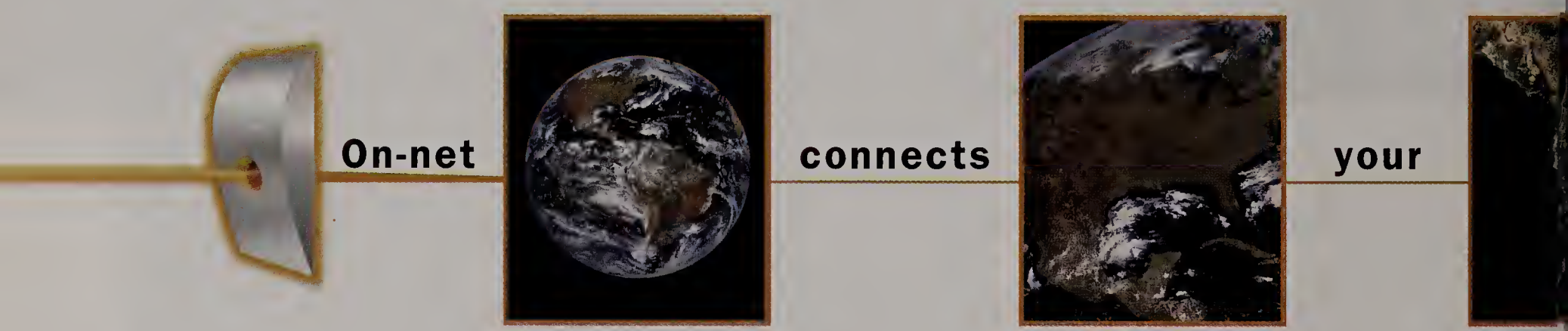
"the throttle factor." That is, if something breaks, CIOs want someone they can call to fix it—or to strangle if whatever's wrong can't be fixed in an acceptable time frame.

This is where vendors such as Red Hat Software Inc., Caldera Systems Inc. and SuSE Inc. come in.These and other companies offer their own versions of Linux with the option of service and support packages customarily associated with commercial software. As corporate demand for Linux grows, these small companies are hastily ramping up their technical resources. "We recognize as a company that we have to develop a whole set of skills to enable the corporate world to rely on Linux," says Bob Young, chairman and CEO of Red Hat in Research Triangle Park, N.C. Red Hat recently increased its facility space by 500 percent in order to expand its 24/7 enterprise support department. Red Hat and companies like it depend on third-party contractors to provide onsite service if necessary. Support options range from $1,000 per server per year up to $60,000 per year for enterprise support packages. "The corporate attitude is that they don't want to track newsgroups [to solve technical problems]; the bulk of the industry simply wants to buy solutions, and so we're scaling up," Young says. Caldera and SuSE are other Linux vendors with similar support initiatives.

Open source software provides no more significant security risk than commercial software or home-grown applications.

The year-old company Sendmail Inc., based in Emeryville, Calif., and founded by the original author of the freeware product, recently began offering the same types of service for Sendmail users, although the pricing for its Sendmail Pro product (roughly $1,300 for a single processor, unlimited user license) is out of whack with the freeware model—Red Hat's shrink-wrapped version of Linux, in contrast, costs about $50. Nevertheless, the emergence of a commercial vendor has made it possible for Sybase's Lin to continue to use Sendmail and enjoy the benefits of its collective development community even though his CIO has officially discouraged the use of freeware.

While the open source vendors get their support departments up to snuff, it is possible to do without. For all the talk that CIOs do not want to troll through



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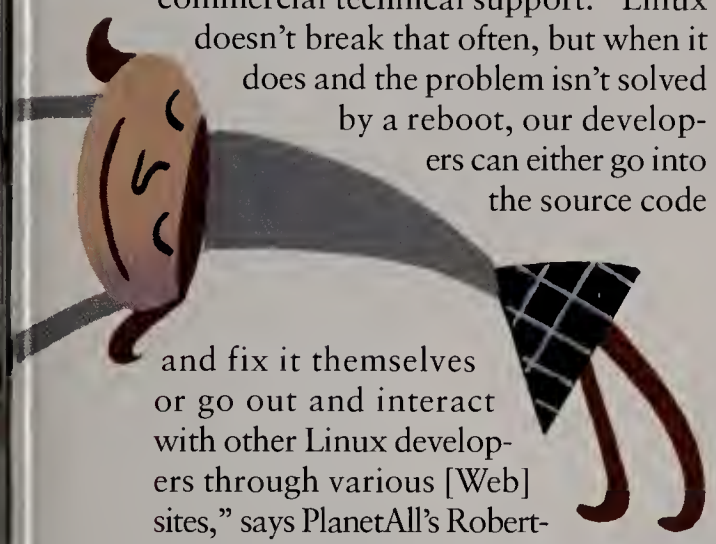
Internet newsgroups to solve technical problems, the companies that do so say it's faster and more effective than most commercial technical support. "Linux doesn't break that often, but when it does and the problem isn't solved by a reboot, our developers can either go into the source code and fix it themselves or go out and interact with other Linux developers through various [Web] sites," says PlanetAll's Robertson. "In 100 percent of cases where we have asked for developer help, somebody has run into the problem before."



SAIC's Davidson and his group were skeptical of the effectiveness of using newsgroups for technical support, so before implementing Linux they posted test questions in various places to check the depth of technical expertise available online and the speed with which they could find answers. "You can get virtually any question answered within four hours," Davidson reports.

To make the community support model work in big-company IS, though, CIOs should plan on funding, encouraging or even creating the local open source support group. "You need to be prepared to become the kingpin of a group of other major users of the software," says Stanley Klein, a consultant based in Rockville, Md. "[The organization is] going to have to become more knowledgeable in order to use that kind of support."

That is exactly the route that both Schlumberger and Cisco have taken. Schlumberger's Sims says a company bulletin board for Linux support connects about 100 people from 62 different company sites to share tips and insights. Cisco, meanwhile, hosts meetings of the Silicon Valley Linux Users Group at its corporate digs. Solvik also notes the need to ensure that cross-training happens within his organization so that it is not overly dependent on a limited number of technical gurus who know how to interact with the open source community. Cisco runs Red Hat's version of Linux but does not rely on Red Hat for support. "I think when you're going to implement open source software for a mission-critical application in a big company, you have to go through a process of determining that you have the resources to support it yourself," says Solvik.

Indeed, Solvik has gone a step further than simply using freeware: In the spirit of open source he has made the code for the company's print architecture publicly available, effectively giving something back to the community that develops Linux. After all, he says, that's the whole idea behind freeware. CIO

Senior Writer Derek Slater can be reached at dslater@cio.com.

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Emerging Technology

THE STATE OF THE ART, NEW PRODUCTS AND STAYING AHEAD OF THE CURVE

Edited by Howard Baldwin

Self-Service Information Retrieval

With enterprise reporting software, reports are cheaply and easily accessible on your intranet

BY PETER RUBER

FUND-RAISING IS NOT A LEISURE-TIME ACTIVITY for the Office of Development at Yale University in New Haven, Conn. It's a full-time job for 160 people who have been enormously successful over the past five years, including raising $1.7 billion in the largest single campaign ever conducted by any university in the country. But considering how time-consuming it was to get historical contribution information out of the university's database, it's amazing Yale was that successful.

The personal computers in the Office of Development had no way of directly accessing the Oracle databases that resided on an IBM RS/6000 four-processor server in the university's data center. Fund-raisers had to write detailed requests on slips of paper, which guided administrative assistants in querying the database. Then they often had to wait 24 hours for the reports to be delivered.

Every organization has groups of users like the Yale fund-raisers who could be more productive in their jobs if they had direct access to corporate-blessed information sitting in overstuffed data warehouses and repositories, says Bob Moran, director of decision-support research at Boston-based Aberdeen Group Inc.

But there haven't been tools available that provide a single desktop view into a data warehouse and allow users to browse HTML screens of standardized reports or even request customized reports. Traditional business intelligence tools have been structured to provide very specific kinds of query, analysis and reporting to serve the needs of the financial, sales and marketing organizations within a company. Their cost and the extensive training they require make them difficult to deploy throughout an enterprise.

However, trends indicate this scenario is changing rapidly. Enterprise reporting tools are coming to the masses, according to International Data Corp. of Framingham, Mass. (a sister company to CIO Communications Inc.), whose analysts predict enterprise reporting will be the fastest-growing segment of the information access tools market between 1998 and 2002. During this period the total query and reporting market is expected to grow at an aggregate of 30 percent per year, from $827 million to $3.1 billion; while the enterprise reporting segment will grow at the rate of 76 percent per year, from $55 million to $933 million.

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ILLUSTRATION BY DAVID MCLIMANS

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Emerging Technology

One can readily understand why enterprise reporting tools are in demand simply by looking at what has taken place at Yale's Office of Development. After years of patiently waiting for others to deliver reports, fund-raisers will soon begin generating their own reports, thanks to an enterprise reporting suite from Sqribe Technologies Corp. "I have always envisioned placing a software solution in the hands of our nontechnical fund-raisers that was simple to use yet was as powerful as the query and reporting tools used by the IT administrators," says Senior IT Project Manager Marcia Schels.

During last summer, Sqribe consultants assisted the university in linking the reporting system to the IBM database server, which will run Sqribe's SQR Server engine and Sqribe ReportMart, a companion product that provides repository, management and security capabilities for enterprise information delivery.

Enterprise reporting tools are yet another validation of the Web-based development environment. The point of integration for enterprise reporting solutions is the Web server and, more typically, the company intranet. You either bring standard reports from back-end systems to the Web server, which users can browse for their specific information needs, or you set up direct links to those back-end systems for ad hoc queries.

"CIOs are looking for these types of self-service and zero-support applications," says Philip Russom, director of the business intelligence service at the Hurwitz Group Inc. in Framingham, Mass. "Overburdened IT departments are reluctant to deal with the training and support issues when [heavy-duty] business intelligence tools are placed into the hands of hundreds and thousands of nontechnical users."

Distributing Knowledge

You may balk at buying still more tools, but you need to consider how information access will help the enterprise as a whole, not just the corporate analysts. Enterprise reporting tools are relatively inexpensive. Pricing for several leading products is in the $20,000 to $35,000 range, and you can actually leverage

IBM Orders "Silicon on Insulator" to Go

Making chips faster, cooler

IT MAY SOUND LIKE A COMPUTER's idea of a sandwich order, but "silicon on insulator" (SOI) is actually the name of a new technology developed by IBM for high-speed, low-power chips.

Chris King, vice president of marketing in IBM Corp.'s microelectronics unit, describes SOI as a breakthrough that will lead to a new generation of mobile products. "Besides allowing the development of smaller systems with longer operating times, it will permit manufacturers to give their products more capabilities, such as real-time voice recognition."

The technology works by placing a chip's transistors on top of an insulating material. The insulation safeguards the transistors from electrical interference, which saps energy and hinders performance.

SOUPED-UP SILICON

King says the technology provides two main benefits. "On the one hand, SOI reduces the amount of power necessary to operate chip circuitry, thereby extending the battery life of portable devices." He notes that SOI chips require as little as one-third the power of equivalent devices without SOI. On the flip side, the technology can enhance performance in almost any device by about 25 percent to 35 percent. "This will allow a processor designed to operate at about 400MHz to achieve speeds exceeding 500MHz."

SOI technology arrives after 15 years of painstaking and often frustrating research. "The researchers were led down a number of different and sometimes misleading paths," says King. "At last, a technique was found that works in the real world." IBM's approach to creating an SOI chip implants doses of oxygen beneath a silicon wafer's surface. The wafer is then cooked at high temperature until a thin film of insulating silicon dioxide forms on top of the wafer; a thin layer of silicon remains on top of that. The transistors placed on this top silicon layer can switch faster because they encounter less electrical friction.

SOI dovetails nicely with IBM's recent copper chip technology breakthrough (see "Fast Chips," *CIO* Section 1, May 1, 1998). While copper technology improves the wires that link a chip's transistors, SOI enhances the operation of the transistors themselves. "SOI completes the transformation that began with the introduction of copper technology," says King.

IBM plans to incorporate SOI into a wide range of chips, including its PowerPC processor and the custom devices it builds for product manufacturers. Pricing is not yet available, but IBM claims that the technology's added process boosts manufacturing costs only slightly. The firm has already begun manufacturing SOI chips at a pilot production line in Fishkill, N.Y. IBM is planning to launch full-scale production by the middle of this year.

–John Edwards

ILLUSTRATION BY DAVID MCLIMANS

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those past investments. Enterprise reporting software will integrate with existing data warehouses, repositories and business intelligence tools as well as the security policies and access rights that have been defined already. In fact, analysts point out, they will deliver more consistent views of information to everyone, which older, rigidly structured tools don't always do.

Forrester Research Inc. in Cambridge, Mass., has reported that there are several key reasons why companies should consider implementing enterprise reporting. Midlevel managers who are part of the decentralized decision-making process must operate with actual business metrics in the "extended enterprise" of suppliers, vendors and customers. They must also be able to do ad hoc queries and build business context on-the-fly for timely, relevant information.

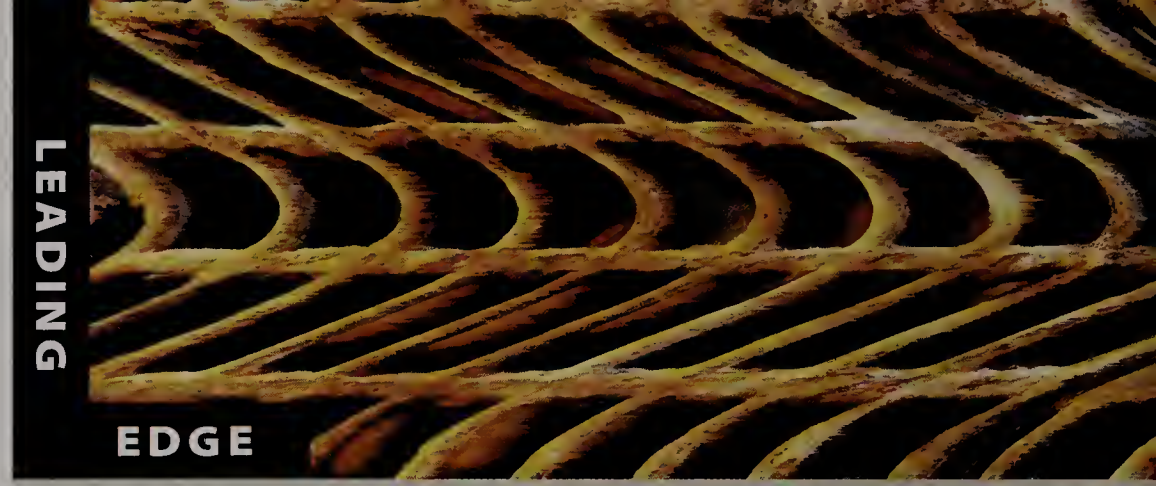
But useful information isn't just stored in data warehouses, the Forrester report continues. ERP applications from companies such as SAP AG, Baan Co. NV, J.D. Edwards & Co. and PeopleSoft Inc. are a rich source of information that could benefit a wider base of users. However, you don't want users to query a live production system. So it's best to feed selected data into standardized reports on a Web server and let users access only pertinent information. This underscores the importance of separating business information from operational data and decision-support functions from transactional processing.

Eliminating the Paper Chase

Defining what type of information will benefit which groups and the level of detail they will need for their work area is not easy. At PCS Health Systems Inc. in Scottsdale, Ariz., David Thompson, vice president of Internet development, says he has begun to phase out the printing of 4 million pages of Cobol-based reports every month.

PCS, the largest organization of its kind, manages the prescription drug benefit programs for health insurers and HMOs serving more than 56 million Americans. Thompson is now faced with the considerable challenge of what he calls "weaning people off the desire to see paper."

Work on eliminating paper started 18 months ago, when PCS began moving its reports into an IBM OnDemand repository, which selected users could view on their desktop PCs. These included internal managers as well as major insurance companies and HMOs that are linked into the company's wide area network. PCS is making progress—it has already reduced the amount of paper reports by 25 percent, to 3 million pages per month, and expects to reduce the amount by another 25 percent to 40 percent this year.



Remote Systems Management

If your operations are global, there's no way you or your staff can keep an eye on all the systems all the time; everybody's gotta sleep sometime. Sure, you can have three shifts a day, but what if one of your systems is in a branch office somewhere? It may be important but not enough to warrant a human watchdog. What about a different kind of overseer? Forsythe Solutions Group Inc.'s **ITWatch** provides 24-hour remote network, systems and desktop management through a Web interface so that you or your staff can track it anytime. By doing so, you can spot performance or capacity problems before they affect production, retrieve status information on a daily, monthly or quarterly basis, and establish consistent service-level agreements throughout the organization.

ITWatch can manage systems running Microsoft Corp.'s Windows NT, Hewlett-Packard Co.'s HP-UX or Sun Microsystems Inc.'s Solaris, monitoring disk and CPU utilization and managing file systems, backup and applications. On the network, it can monitor performance and manage router security, events and configuration. On the desktop, it can manage inventory, do software distribution and license metering, and track configurations. Startup fees range from $150 to $5,000, depending on platform (average is $200 per device); maintenance fees range from $50 to $700 per device per month (depending on platform). For more information, call 847 675-8000 or visit *www.forsythesolutions.com.*

Documenting Object Development

The least fun of application development is documentation. The hard part's over...who wants to sweep up? Nonetheless, developers are almost always called on to present reports or presentations about their work, and Synergex International Corp.'s **Model EyeQ** tries to make that preparation as easy as possible. Working with a variety of object-oriented development packages, the software lets developers extract visual and textual information from an object-oriented model easily so that they can create Microsoft Word files for reports, Microsoft PowerPoint presentations, HTML files for the Web or just plain text. The ultimate goal is better collaboration between developers and the users of their applications.

The software incorporates templates for generating documentation, and it lets users customize and modify the templates easily. It integrates with Rational Software Corp.'s Rational Rose and Microsoft Corp.'s Visual Studio modeling tools and runs on Microsoft Windows 95, 98 and NT 4.0. The price is $995 per seat. For more information, call 916 635-7300 or visit *www.modeleyeq.com.*

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Emerging Technology

The next phase is even more ambitious. The OnDemand repository is being given a Web-based interface so that everyone can access reports through a browser over the Internet. Because distributing confidential information over the Internet poses a number of security risks, PCS is setting up digital certificates for each client. "The user's ID and password restricts access to only the data for that client," says Thompson.

At DHL Airways Inc., based in Redwood City, Calif., a similar paper flood prompted Malcolm Duff, senior IT manager for sales, marketing and logistics, to move its report distribution from the mainframe to a data warehouse, with reports accessible from a self-service intranet with Actuate Software Corp.'s enterprise reporting suite. Since a number of the reports are too large and would take too long to download from the intranet, says Duff, "we'll be distributing the Actuate-based reports on a CD-ROM. It's like giving users a mini-database." Sales offices can search these databases with Actuate's Web plug-in, slice and dice customer, revenue and product information, and even cut and paste information into Excel spreadsheets.

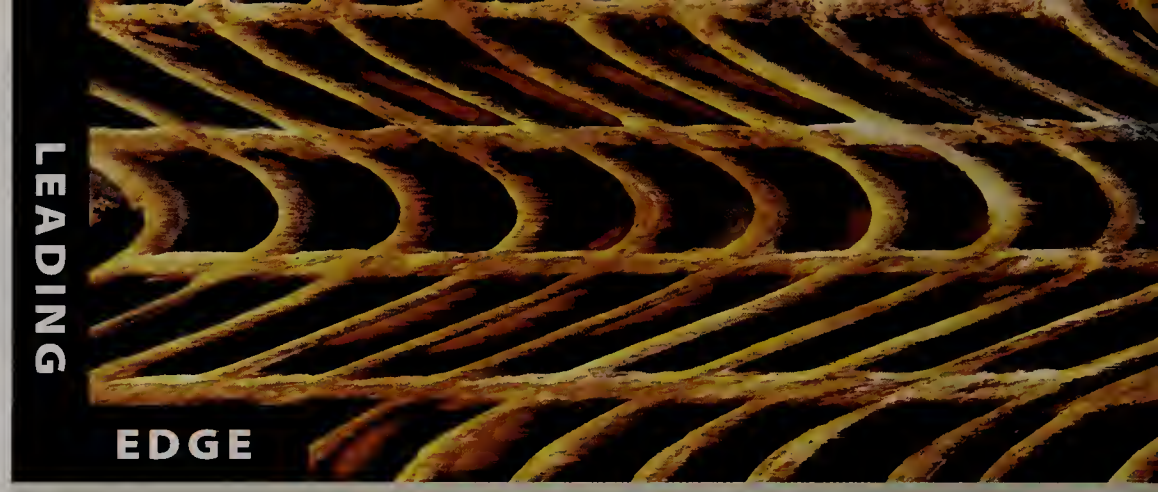
More Timely Information

While some companies view reducing the volume of printed reports as a way to save trees, their real purpose is to make more information available on a self-service basis. When users have access to current information, they can react faster to potential problems and capitalize on market opportunities. The enterprise reporting tools that are making this a reality are being developed by companies such as Actuate, Brio Technology Inc., Business Objects SA, Cognos Inc., CorVu Corp., Datawatch Corp. and Sqribe. They have a leg up on the senior players in the query, analysis and reporting market, says Hurwitz's Russom.

But overall, enterprise reporting is coming from other segments of the information access tools market as well. Among the trends IDC has noticed is that OLAP vendors are taking advantage of Web technologies and that enterprise application vendors are partnering with enterprise reporting vendors.

As enterprise reporting tools continue to mature, not only will more user communities like Yale's Office of Development do better prospect tracking on their own, but managers will also be able to track staff productivity in ways they haven't been able to do in the past. CIO

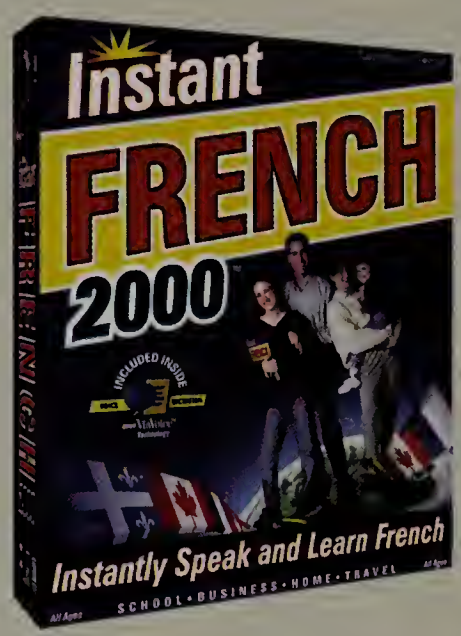
Peter Ruber is a business technology writer based in Oakdale, N.Y. He can be reached via e-mail at lbsb20a@prodigy.com.



Translate, Please

THERE'S NOTHING MORE DAUNTING THAN COMING ACROSS A Web site that's been written in another language or trying to communicate with a client or colleague whose first language isn't yours. LanguageForce Inc.'s **Instant Language 2000** tries to alleviate that problem with real-time communication, dictation and translation.

The software offers multiple capabilities. With the proper hardware, users can either type words or speak English at their computers and have it translated (and read back) in another language (currently Spanish, French, German and Russian are available). Users can also point to words on a Web site and hear them pronounced in English.



Combined with an Internet chat room, users can translate words spoken by participants in other countries. There's also a vocabulary builder for teaching words and phrases useful in foreign travel.

Priced at $90 per user, Instant Language 2000 requires a PC with at least a 100MHz Pentium processor, Windows 95 or 98, 16MB of RAM, 4MB disk space, a sound card, CD-ROM drive and microphone. For more information, call 714 279-9080 or visit *www.languageforce.com.*

Faster Service in the Field

FIELD SERVICE PERSONNEL HAVE PLENTY OF TOOLS TO CARRY without being weighed down by a laptop computer as well (and laptops aren't known for their ability to bounce from service call to service call). Outfitting field service reps with handheld computers may diminish weight concerns, though. FieldCentrix Inc.'s **FieldCentrix Enterprise** software aims to fill in the gaps between the folks in the field and the data back in the enterprise. The goal: better tracking of who's where and what they're doing.

The software consists of two pieces. FX Mobile runs on a handheld computer running Microsoft Corp.'s Windows CE and gives technicians automatic time sheets, electronic work orders, equipment inventory by job site, bar coding, street maps, customer history, messaging, additional service opportunities and wireless database access. Technicians can also capture signatures and print out invoices or receipts on the spot. The second piece, FX Service Center, runs on a Microsoft Windows NT server and automates operations, dispatch and management throughout the company.

Pricing ranges from $200 to $250 per technician per month, based on a three-year contract incorporating hardware, software and wireless charges. For more information, call 949 851-7800 or visit *www.fieldcentrix.com.*

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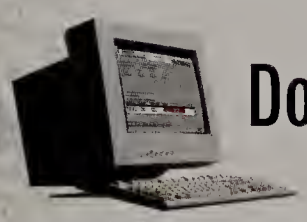

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Nielsen Media Research's Software Estimation System

FRUSTRATION USED TO BE BUILT into the lives of product managers at Nielsen Media Research Inc.'s main operations center in Dunedin, Fla. Until last year, software projects went through a rigorous analysis process centered around Gantt charts that graphically map production tasks, staff levels and milestones to help managers estimate the cost and time of software projects that Nielsen Media develops for its customers—TV stations, advertisers and broadcast and cable networks. Unfortunately, the Gantt charts proved inaccurate, sometimes woefully so. By recording tasks rather than software functionality, Gantt charts were prone to optimistic projections.

"People often estimated tasks based on their best hopes," recalls Kim Ross, CIO of the TV ratings and analysis company. With each person giving his best estimate for each task—and sometimes omitting tasks in an effort to shorten the product development cycle—the Gantt charts were off by an average of 106 percent.

That degree of inaccuracy not only took a toll on product managers' morale, but customer service suffered because Nielsen Media couldn't reliably tell customers when software products would be available or how much they would cost. "We collect and process 11 million minutes of TV viewing information from more than 22,000 homes every day," says Ross. "A big part of our business is developing software products that let our customers access our databases."

In November 1996 Nielsen Media hired Software Productivity Research Inc. (SPR) of Burlington, Mass., to analyze its software development process. SPR's KnowledgePlan software estimation tool worked so well for self-analysis that Nielsen Media decided to use it as a projection tool to plan, track and manage future software development projects.

In January 1998 Nielsen Media began to use KnowledgePlan for estimating software projects in various stages of development, from the initial design phase to enhancements of existing products. Development staff members are trained to use the PC-based package and are supervised by Nielsen Media's Process Quality control group because modeling projects accurately calls for a certain amount of expertise. Three quality managers work with project and product managers to define the scope, size and resources of client/server-based and mainframe-based projects. The quality managers input the information into KnowledgePlan, and out comes a project model complete with estimates for worker hours, costs and time-to-market.

Instead of focusing on task documentation as it did with the Gantt charts, Nielsen Media now uses a statistical method called function point analysis to measure the number of lines of code that a project will require, which becomes one of the inputs to KnowledgePlan. Ross believes that analyzing a project's function points—anything that relates to end-user interfaces such as data sources and screen functions—is the best indicator of a project's scope because the estimate is based on actual statistical models.

Creating what-if analyses by changing project variables gives developers greater insight into where projects get off track. "A model will show that doubling team size doesn't mean that a project will be done in half the time," says Ross. Project managers didn't have that kind of cause-and-effect information before.

So far, Nielsen Media has modeled 13 projects with the KnowledgePlan software, and 7 more are in the works. One of the first projects that went through the new process came in within 8 percent of the original estimate, a significant improvement over the old method. As more project estimates use function point analysis and KnowledgePlan from start to finish, Ross will start compiling metrics to improve the development staff's productivity further.

"We expect to see an improvement toward a perfect estimate," says Ross. When Nielsen Media achieves that milestone, Ross believes that other advantages will follow. Not only will Nielsen Media save money by reducing project bloat, but when products get to market on time the company can enjoy incoming revenues that much sooner. CIO

Vital Statistics:

- **Organization:** Nielsen Media Research Inc., Dunedin, Fla.
- **Application:** Software project estimation system
- **Technologies:** Software Productivity Research Inc.'s KnowledgePlan project estimation software running on a PC
- **Scope:** Approximately 100 employees
- **Sponsor:** Kim Ross, CIO
- **Objective:** To benchmark software development efforts and improve customer service
- **Payoff:** Improved project management and project estimation processes

Senior Editor Megan Santosus can be reached at santosus@cio.com. *Send Working Smart ideas to Features Editor Meg Mitchell at* mmitchell@cio.com.

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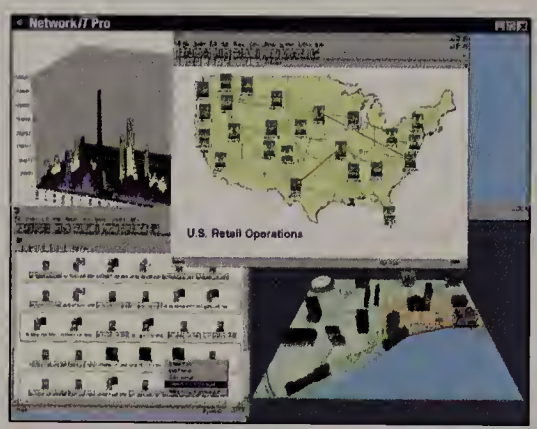

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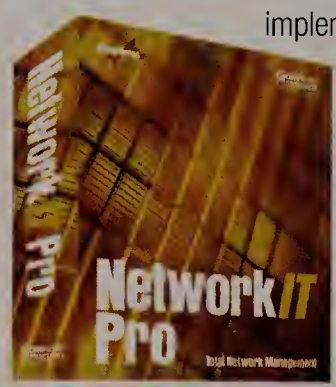

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